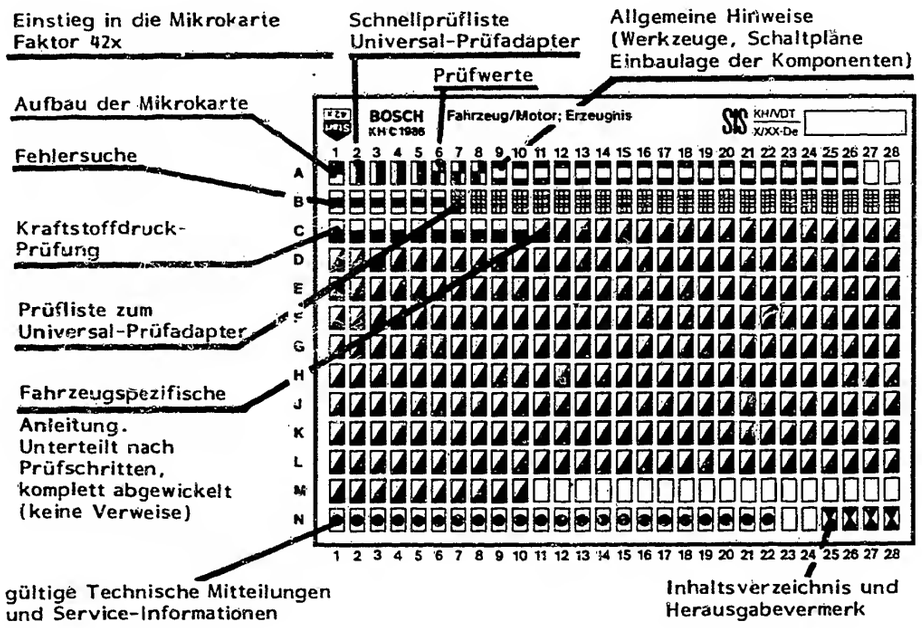


LAYOUT OF THIS MICROCARD

1. Read from left to right.

2. Title of microfiche (appears on each coordinate).

E16	Product/component/test step	

Coordinate

3. Limits of section

==>	<==>	<==	=> <=
Beginning	Mid-section	End	One-page Section

SPECIAL FEATURES

* This microcard contains the LU 2 - Jetronic trouble-shooting instructions for the following OPEL models valid at the time of printing:

  Kadett 1.8 i (4.85 ->)
  Ascona 1.8 i (85 ->)
  Rekord 1.8 i (85 ->)
  Lambda closed-loop control

* LU2-Jetronic with 25-pin control unit, 5-pin air-flow sensor, 7-pin control relay, solenoid-operated injection valves with brass-wire coil
* Cold-start control, i.e. extra fuel injected through all injection valves.
* No start valve or thermo-time switch.
* Heated lambda sensor for lambda closed-loop control and three-way catalytic converter.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER

The following rapid diagnosis chart makes it possible for the experienced L-Jetronic expert to quickly check the electrical part of the system with the universal test adapter.
The rapid diagnosis chart contains the following information:

* Sequence of test steps.
* Settings of V and Ω program switches.
* Notes on how to operate the universal test adapter or other components.
* Test specifications for motortester and multimeter.
* Reference to Coordinates of the relevant detailed testing and trouble-shooting program.

If detailed instructions and information are required, always proceed according to the trouble-shooting charts starting on Coordinates B01/B02.

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER

Test step	Switch position V	Switch position Ω	Measurement	Control-unit plug between term.	Remarks	Test specifications (reading)	For trouble-shooting see Coordinates
1	5	–	Voltage pulses from ignition coil term. 1	1 <⟹> 5	Shift gear to neutral, start.	Ignition pulses on oscilloscope	B09
2	6	–	Voltage from control relay term. 87	9 <⟹> 5	Shift gear to neutral, start.	8 ... 15 V	B11
3	7	–	Voltage from ignition/starting switch term. 50	4 <⟹> 5	Shift gear to neutral, start.	8 ... 15 V	B13
4	V	11	Resistance of temperature sensor NTC I in air-flow sensor term. 8	8 <⟹> 5	None	100 ... 200 Ω	B15
5	V	12	Resistance of potentiometer in air-flow sensor term. 7	7 <⟹> 5	Deflect air-flow sensor flap as far as it will go.	60...1000 Ω	B17
6	V	13	Resistance of temperature sensor NTC II term. 10 (engine temp.).	10 <⟹> 5	(+ 15° C...+ 30° C): (+ 80° C) :	1,45...3,3 k Ω 280 ... 360 Ω	B19
7	V	14	Resistance of output-stage ground term. 13	13 <⟹> 5	None	0 ... 10 Ω	B21
8	V	16	Resistance of idle contact in throttle-valve switch term. 2	2 <⟹> 9	Accelerator in rest position: Accel. slightly depressed:	0 ... 10 Ω Infinity Ω	B23
9	V	17	Resistance of full-load contact in throttle-valve switch term. 3	3 <⟹> 9	Accelerator in rest position: Accelerator in full-load position:	Infinity Ω 0 ... 10 Ω	B25
10	V	18	Resistance of all 4 parallel-connected solenoid-operated injection valves term. 12	12 <⟹> 9	(+ 15° C...+30° C) : (+ 80° C) :	7,0 ... 9,5 Ω 7,2 ... 10,0 Ω	B27

A03 — <⟹>

A04 — <⟹>

Additionally required checks on leads:

The following components with the asso-
ciated connecting leads are not covered by
the univ. test adapter in the rapid diag.:

* Auxiliary-air device

  Connecting leads 26 = Ground lead
  Connecting leads 9/2 = Pos. lead via contr.
                         relay term. 87.

* Electric fuel pump

  Connecting lead 61 = Ground lead
  Connecting leads 28 = Pos. lead via contr.
                         relay term. 87b

* Lambda sensor

  Heating
  Connecting lead 74 = Ground lead
  Connecting leads 91 = Pos. lead via contr.
                         relay term. 87b

  Sensor lead   20 = Sensor signal
  Shielding   5/3 = Ground lead.

For production reasons:
continued on the following
coordinate.

TEST SPECIFICATIONS

C a u t i o n !

The Coordinates given on the right refer specifically to the section within a trouble-shooting program in which this test occurs. Afterwards, do not continue in this trouble-shooting program, but in the test-specifications section or in the trouble-shooting chart.

| C01 |

Pressure regulator
* Fuel pressure 2,3...2,7 bar

| J11 |

Electric fuel pump
* Fuel delivery (measured in return) min. 700 cm ^{3} /30s
* Terminal voltage (under load): min. 12 V

| B19 |

Temperature sensor II
(Engine) color of plug blue
* Internal electrical resistance at ambient temperature (+ 15° C...+ 30° C): 1450...3300 Ω
with engine at op. temp. (approx. + 80° C): 280... 360 Ω

| F07 |

Solenoid-operated injection valve
* Internal electrical resistance at ambient temperature (+ 15° C...+ 30° C): 15,0...17,5 Ω

| D11 |

Air-flow sensor
* Internal electrical resistance between:
Term. 8 and term. 5: 340... 450 Ω
Term. 7 and term. 5: 60...1000 Ω (+)
Term. 8 and term. 9: 160... 300 Ω
Term. 9 and term. 5: 500... 760 Ω
(+) Deflect air-flow sensor flap as far as it will go.

| A07 | — | ⟹ |

| D09 |

Auxiliary-air device
* Internal electrical resistance 30...65 Ω

| M03 |

Idle adjustment
* Idle speed
Manually shifted transmission 850...900 min $^{-1}$
Manually shifted transmission 900...950 min $^{-1}$
Automatic transmission: 800...850 min $^{-1}$

* CO adjustment via lambda closed-loop control

Closed-loop mode (sensor connected):
Voltage reading fluctuates between 2 values.

Open-loop mode (sensor lead taken apart):
Voltage reading must be identical with the average value of the fluctuating reading.

| G01 |

Lambda closed-loop control
* Rich value
(Take sensor lead apart and touch lead coming from control unit against ground): 10...12 V
* Lean value
(Apply 2 V to the sensor lead coming from the control unit): approx. 0,5 V

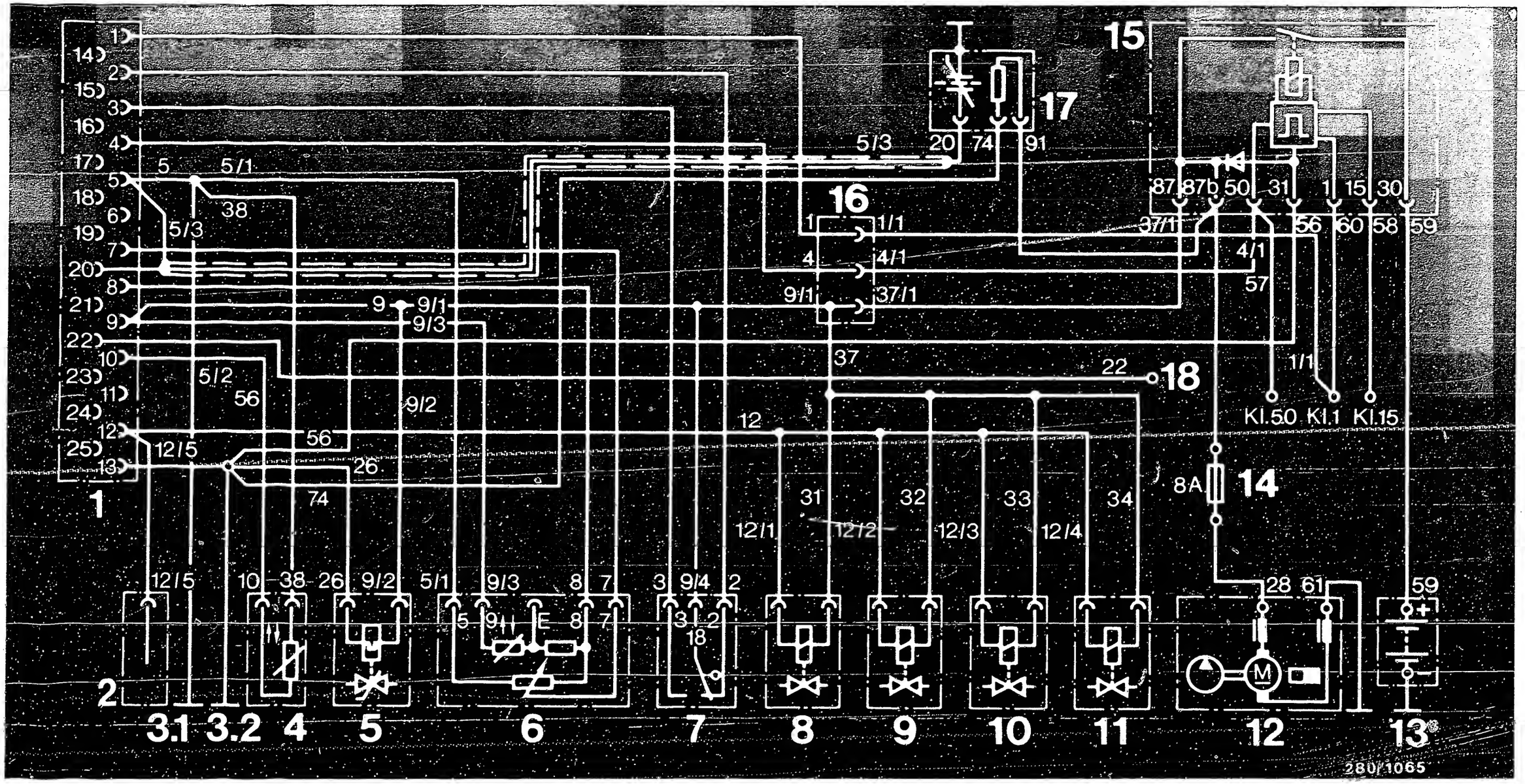
Switch off extractor system while measuring and adjusting the exhaust gas.

| G01 |

Lambda sensor heating
* Internal electrical resistance (PTC): 1...10 Ω

See equipment and Autodata microcards for settings for ignition, valve clearance and other engine data.

| A08 | — | ⟸ |

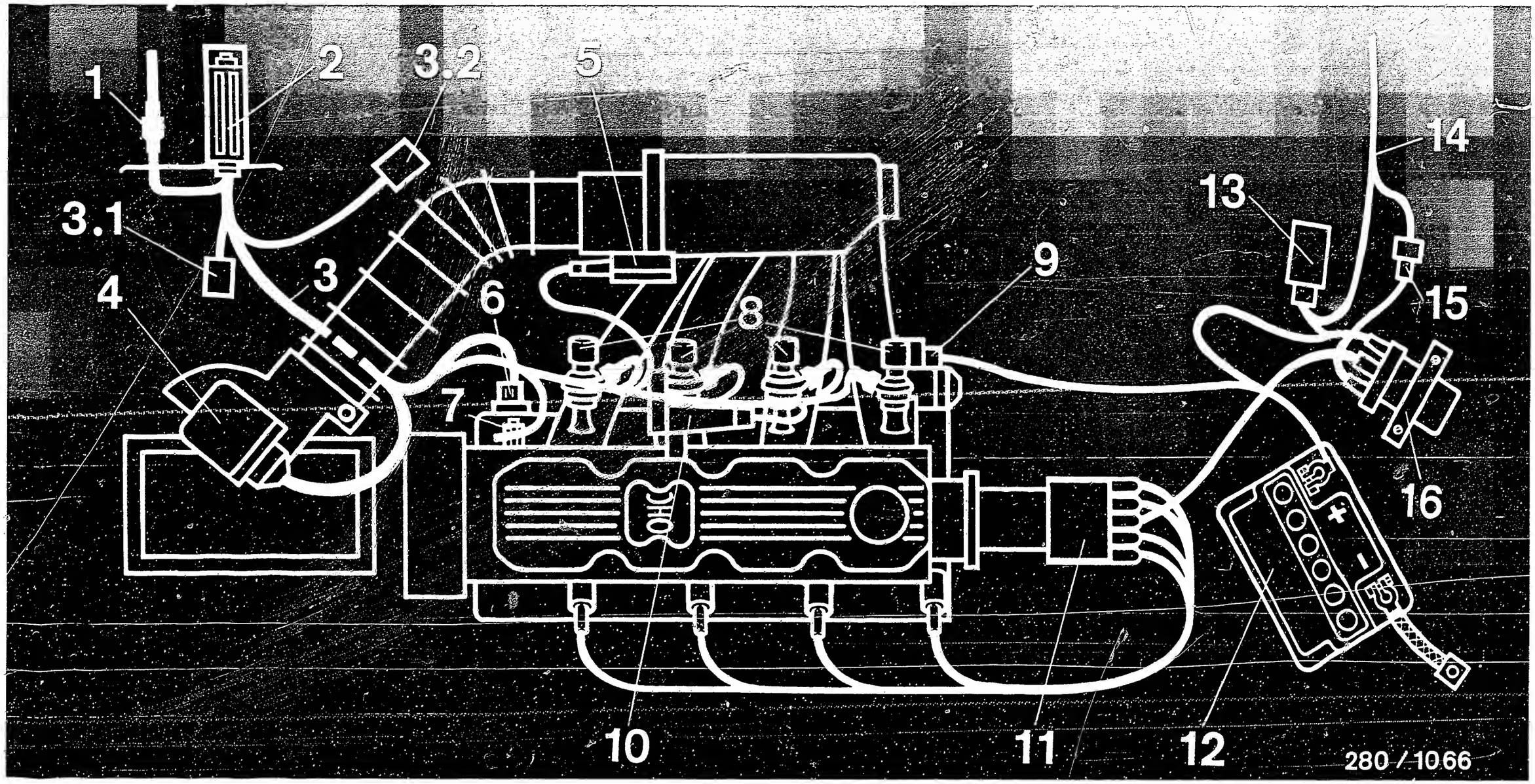


ELECTRICAL TERMINAL DIAGRAM

1 = Control-unit plug
2 = On-board computer
3.1 = Electronics ground term.
3.2 = Output-stage ground term.
4 = Temperature sensor II (engine temperature)
5 = Auxiliary-air device
6 = Air-flow sensor
7 = Throttle-valve switch
8,9,10,11 = Injection valves
12 = Electric fuel pump
13 = Battery
14 = Pump fuse
15 = Control relay
16 = 3-pin plug-in connection
17 = Lambda sensor
18 = Integrator test pin (lambda)

A09 ⟹

A10 ⟸



ELECTRICAL WIRING DIAGRAM AND ARRANGEMENT OF INDIVIDUAL COMPONENTS

1 = Plug-in connection term. 1
2 = Control unit
3 = Jetronic wiring harness
3.1 = Integrator test pin (lambda)
3.2 = 3-pin plug-in connection (lambda)
4 = Air-flow sensor
5 = Throttle-valve switch
6 = Temperature sensor II
7 = Ground terminals
8 = Injection valves
9 = Starting motor
10 = Auxiliary-air device
11 = Ignition distributor
12 = Battery
13 = Control relay
14 = Vehicle wiring harness
15 = 3-pin plug-in connection
16 = Ignition coil

A11 ==> A12 <==

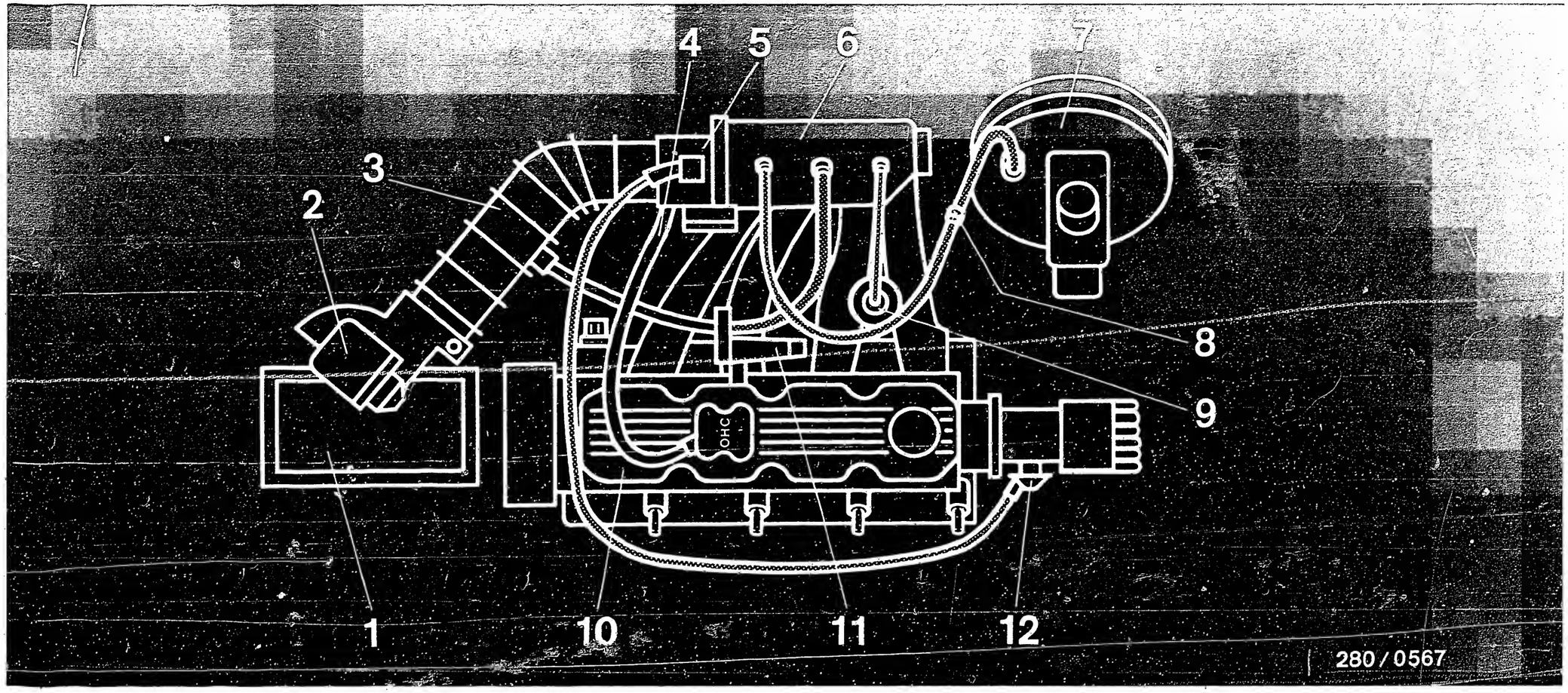


DIAGRAM OF AIR LINES

= Intake manifold pressure

= Atmospheric pressure

1 = Air filter
2 = Air-flow sensor
3 = Air-guide hose
4 = Crankcase ventilation
5 = Throttle-valve assembly
6 = Intake manifold
7 = Brake booster
8 = Non-return valve
9 = Pressure regulator
10 = Valve cover
11 = Auxiliary-air device
12 = Ignition advance unit

A13 ⟹

A14 ⟸

TEST STEP 3 (TEST SPECIFICATIONS AND NOTES ON OPERATION)

Component / Function:
Starting signal at control

* Trouble-shooting:
For testing, disconnect control-unit plug from test adapter and

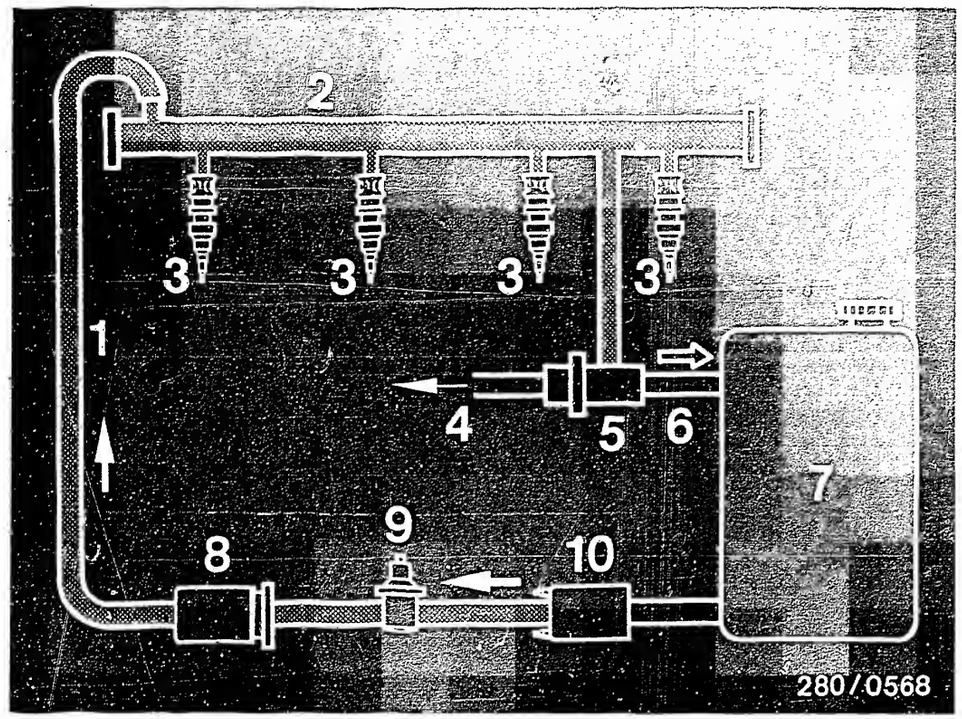


DIAGRAM OF FUEL LINES

= Pressureless

= Fuel pressure

1 = Fuel delivery line
2 = Fuel-distribution pipe
3 = Injection valves
4 = Intake manifold pressure connection
5 = Pressure regulator
6 = Fuel return line
7 = Fuel tank
8 = Fuel filter
9 = Pressure damper
10 = Electric fuel pump

For production reasons:
continued on the following
coordinate.

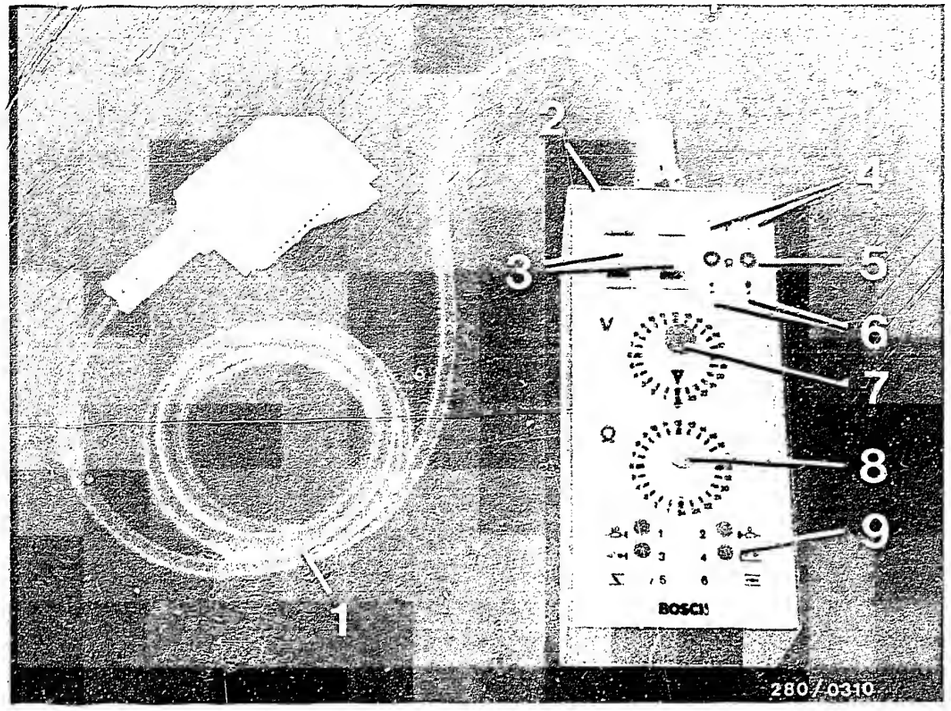
TEST EQUIPMENT AND TOOLS

Description	Designation	Part Number
Universal test adapter Adapter lead	ETT 018.01	0 684 101 801 1 684 463 123
Motortester Test lead	e.g. MOT 002.00 MOT 300 MOT 400	0 684 000 200 0 684 000 300 0 684 000 400 1 684 463 093
Exh. gas analyzer Calibrated analyzers	e.g. ETT 008.00 ETT 008.04 ETT 008.05	0 684 100 800 0 684 100 804 0 684 100 805
Pressure tester e.g. pressure gauge Pressure tester Pressure tester (no longer available) Three-way line	Quality class 1.0 Msg. range 6 bar 0.1 bar graduations	 1 687 231 154 KDJE-P 100 KDEP 1034 KDJE-P 100/13
Electrics tester or multimeter e.g.	ETE 014.00 Philips Miselco Fluke	0 684 101 400 PM 2517 X Master 50 K Multimeter 75
Hexagon-socket-screw key	AF 5	
Solenoid-operated injection valve		0 280 150 205 #

Use suitable commercially available tools for removing and fitting the idle CO anti-tamper device on the air-flow sensor.

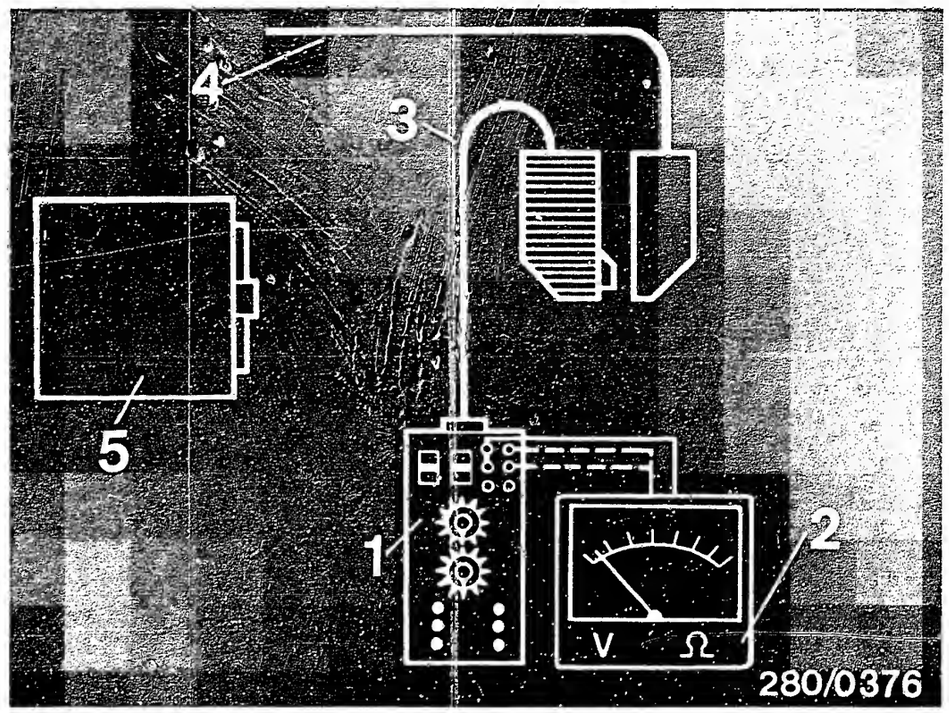
Test equipment and tools (continued)

Description	Designation	Part number
Clamping fixture		1 688 120 093
Assembly mandrel		1 687 931 003
Parts set		1 287 010 701
Lambda closed-loop tester	KDJE-P 600	
Lambda-sensor mounting paste	VS 140 16 Ft	5 964 080 105



UNIVERSAL TEST ADAPTER WITH LU ADAPTER LEAD

1 = Adapter lead
(Part no.: 1 684 463 123
2 = Universal test adapter
(Part no.: 0 684 101 801)
3 = Test wells (for motortester)
4 = Test sockets (for voltage measurements)
5 = Test sockets (for resistance measurements)
6 = Test sockets (not yet assigned)
7 = Program switch " V "
8 = Program switch " Ω "
9 = Button panel (not used for
LU -Jetronic)

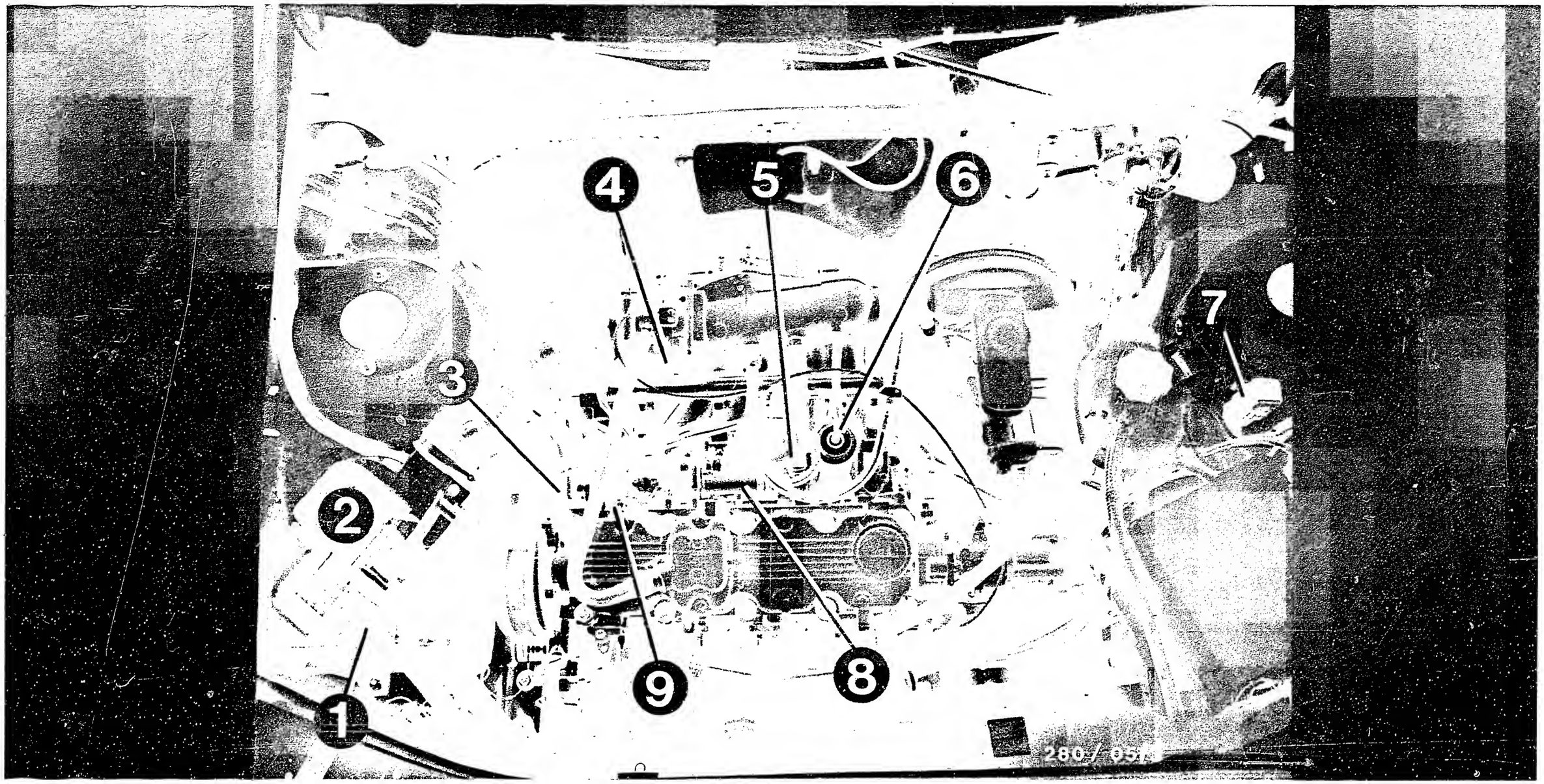


1 = Universal test adapter
2 = Multimeter
3 = LU-adapter lead
4 = Jetronic wiring harness
5 = LU-control unit

Connection:
Disconnect control-unit plug of Jetronic wiring harness from control unit and connect to plug of adapter lead.

C A U T I O N !
Connect and disconnect the universal test adapter only with the ignition off:

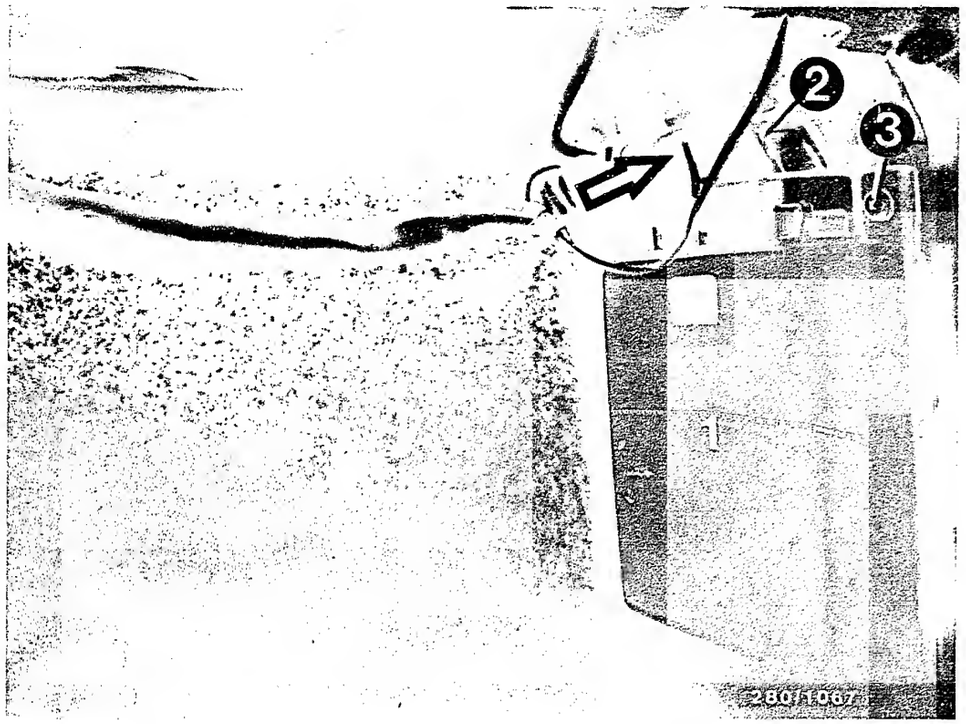
Testing:
For testing, connect a multimeter with R_i = min. 20 k Ω /V to the test adapter.
In addition, the signal from term. 1 of the ignition coil or from term. t_D of the ignition trigger box can be measured with a motortester via the special input.



INSTALLATION POSITION OF COMPONENTS

* Arrangement of components on engine

1 = Air filter
2 = Air-flow sensor
3 = Temperature sensor II
4 = Throttle-valve switch
5 = Solenoid-operated injection valves
6 = Pressure regulator
7 = Control relay
8 = Auxiliary-air device
9 = Ground terminals

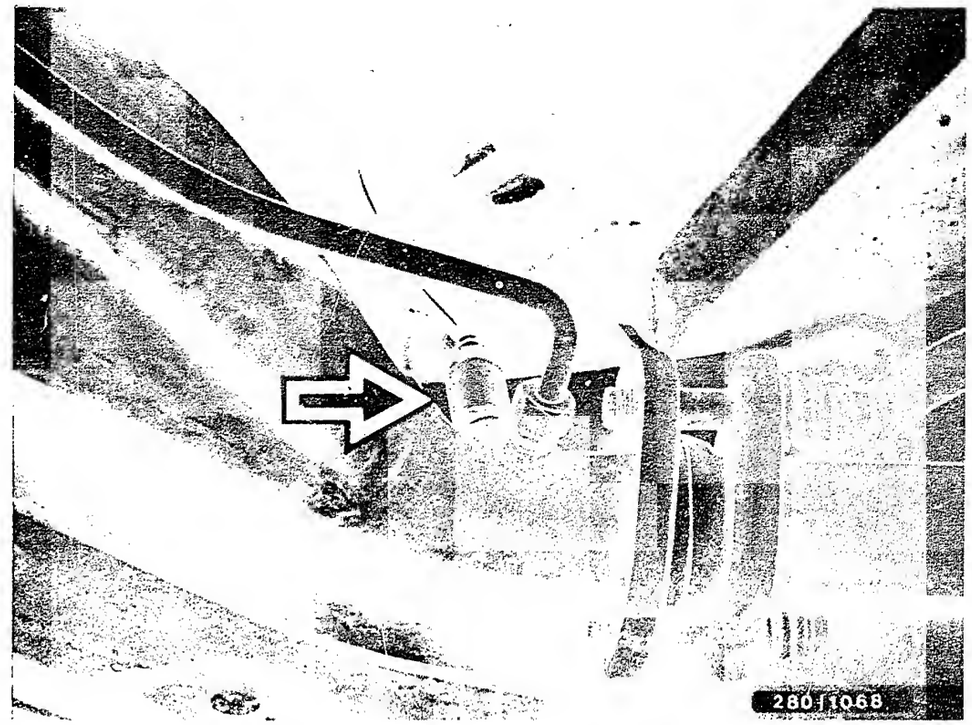


1 = Control unit
2 = 25-pin control-unit plug
3 = Fastening screws

* Control unit in passenger compartment

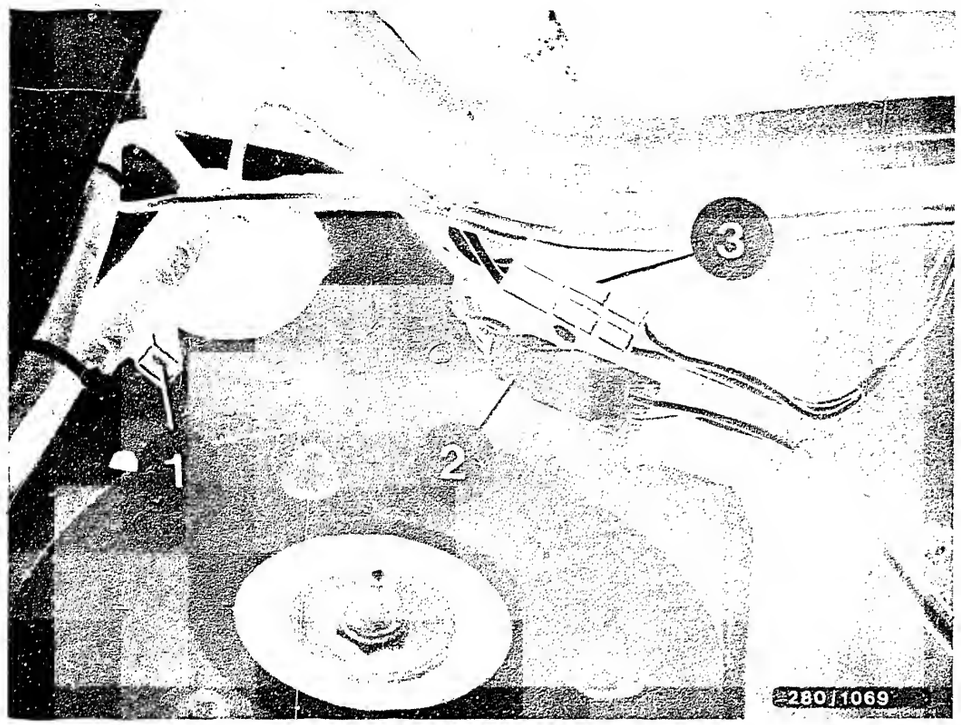
All references to installation positions are as viewed from behind the vehicle

The control unit is located in the passenger compartment on the front-passenger side, at the bottom right of the footwell.
To connect the universal test adapter, pull out control-unit plug (25-pin). To do that press detent in direction of arrow.



Arrow = Lambda sensor

* Lambda sensor screwed into exhaust pipe.



* Plug-in connections

1 = Test pin /integrator voltage of lambda closed-loop control)
2 = 3-pin plug-in connection to Lambda sensor. Sensor signal and heating
3 = 3-pin plug-in connection, power supply. Output for control relay term. 87, starting motor term. 50, ignition coil term. 1.

* Fuel-supply components

Fuel filter, pressure damper and electric fuel pump are on the underside of the vehicle to the right of the fuel tank.

IMPORTANT GENERAL INFORMATION

* Never start the engine without the battery connected.

* Do not use a starting aid with more than 16V.

* Never disconnect battery with engine running.

* To fast-charge the battery, disconnect it from the vehicle electrical system.

* Remove the control unit at temperatures above 80°C (paint-drying installation).

* Make sure that all connectors of the wiring harness are correctly seated.

* Never disconnect or connect the control-unit plug with the ignition on.

* When testing compression, cut the power supply by disconnecting the control relay. This prevents undesired injecting.

* Remove the Jetronic control unit before performing electrical welding work (e.g. spot-welding).

* If an alarm system is installed, proceed according to SIS microcard ALL-500.

* In the following trouble-shooting, it is assumed that engine, ignition and electrical system are O.K.
* Additional information on L-Jetronic:
- VDT - U3/3
- VDT-I-280/...

TROUBLE-SHOOTING CHARTS

Using the universal test adapter with adapter lead (1 684 463 123) and other suitable test equipment, the following trouble-shooting charts are intended to enable the workshop employees to quickly detect causes of trouble on the LU-Jetronic. A choice can be made betwen the following working procedures, depending on the level of training and experience of the mechanic.

* Detailed, step-by-step trouble-shooting chart

  For employees with little practice or experience on LU-Jetronic vehicles.
  Each customer complaint is assigned its own complete trouble-shooting program..... | B03 |

* Direct, pin-pointed trouble-shooting chart

  For trained, experienced employees with a great deal of practice on LU-Jetronic vehicles.
  For each customer complaint, you start with a specific component of your choice within the trouble-shooting program..... | B05 |

Both trouble-shooting charts begin by checking the electrical/electronic part of the LU-Jetronic using the universal test adapter with adapter lead. This quickly checks the electrical operation of the wiring harness with the components connected to it, and faults are soon detected.

If no fault is found with the universal test adapter, it is necessary to perform the fuel pressure test.

If once again no fault is found, continue with the detailed o r the direct trouble-shooting chart.

1. Detailed, step-by-step trouble-shooting chart for the complete trouble-shooting program

* Electrical test with universal test adapter, adapter lead 1 684 463 123 and motortester/multimeter

  This test must come at the start of the testing program and must be performed from beginning to end (Coordinates B07)

* Fuel pressure test with pressure gauge
  This test must come directly after the test with the universal test adapter and must be performed from beginning to end (Coordinates C01)

* Trouble-shooting according to customer complaints (fault symptoms)
  The following table contains possible fault symptoms and the right-hand column gives the first coordinate of the relevant detailed detailed trouble-shooting program.
  This trouble-shooting program consists of logically ordered test procedures for all individual components of the LU-Jetronic.
  If, after completing the trouble-shooting program for an assumed symptom, the fault has not been detected or remedied, choose a new fault symptom and work through another program.

Customer complaints (Fault symptoms)	Electrical test with universal test adapter	Fuel pressure test with pressure gauge	Trouble-shooting program
1. Starting motor operates, engine fails to start	B07	C01	D01
2. Engine starts but then dies	B07	C01	E01
3. Rough idle/incorrect idle speed	B07	C01	F01
4. Poor throttle take-up	B07	C01	H01
5. Engine missing under all operating conditions	B07	C01	J01
6. Fuel consumption too high	B07	C01	K01
7. Max. engine power/top speed not reached	B07	C01	L01
8. Idle speed and CO concentration too low or too high	B07	C01	M01

B03 — <⟹>

B04 — <⟹>

2. TROUBLE-SHOOTING CHART LEADING DIRECTLY TO THE CAUSE OF TROUBLE; FOR COMPONENTS INCLUDED IN THE TROUBLE-SHOOTING PROGRAMS

* Electrical test with the universal test adapater, adapter lead 1 684 463 123 and motortester or multimeter
  The test with the universal test adapter must always be placed at the start of the test program and be carried out from beginning to end. (Coordinates B07).

* Fuel-pressure test with pressure gauge
  The fuel-pressure test must be carried out subsequent to the test with the universal test adapter and must be carried through from beginning to end (Coordinates C01).

* Trouble-shooting following customer complaint
  The table below contains various fault symptoms with several possible causes of trouble in each case. The instruction field shows the starting coordinate for the test sequence of each individual component of the LU Jetronic. If the trouble has not been detected or corrected when testing of the individual components is completed, start again by determining the fault sympton..

Customer complaint (symptom of trouble) 1. Starting motor operates, but engine fails to start or starts only with difficulty	2. Engine starts but then dies	3. Rough idle, incorrect idle speed	4. Poor throttle take-up	5. Engine missing in all operating conditions	6. Fuel consumption too high	7. Maximum engine power/top speed not reached	8. Idle speed and CO concentration too low or too high	Cause (Component fault)
B07	B07	B07	B07	B07	B07	B07	B07	Fault in electrics test with universal test adapater
C01	C01	C01	C01	C01	C01	C01	C01	Fault in fuel supply, pressure regulator faulty, control relay faulty, electric fuel pump not running, fuel-pressure check
D09	E03		H05					Auxiliary-air device does not open
		F05					M05	Auxiliary-air device does not close
D11		F11	H07	J05	K13	L09	M07	Air-flow sensor faulty, potentiometer test (noise test)
D03								Start-control system faulty
D13	E05	F13	H13			L11	M09	Air-intake system leaking
		F07		J19	K03			Solenoid-operated injection valves faulty, connect test lead
				J11		L07		Fuel delivery by electric fuel pump too low
						L03		Exhaust-gas catalytic converter, lambda-sensor interval
				J17				Overrun cutoff
				J19				Wiring harness and plug connections interrupted, parasitics, missing, ground contact
		F03	H03					Throttle valve does not close (check overrun cutoff)
						L03		Throttle valve does not open completely
		F03						Throttle-valve switch faulty (setting)
		F15	H15		K15		M03	CO exhaust-gas setting too rich, idle adjustment
		F15	H15				M03	CO exhaust-gas setting too lean, idle adjustment, coughing
				J17				Control unit faulty
		G01	G01	G01	G01		G01	Lambda closed-loop control system faulty

B05 — <==> B06 — <==

TEST CHART FOR UNIVERSAL TEST ADAPTER
with adapter lead 1 684 463 123
for LU-Jetronic

* Before testing with the universal test adapter, check all multiple plug connections for loose contacts. Clean contacts if dirty or corroded.
* Watch for blade receptacles that have been pushed back. If necesssary, bend back locking tab and press blade receptacle as far as it will go into plug housing; locking tab latches.
* Suspicion of line breaks in case of kinking and pinching.

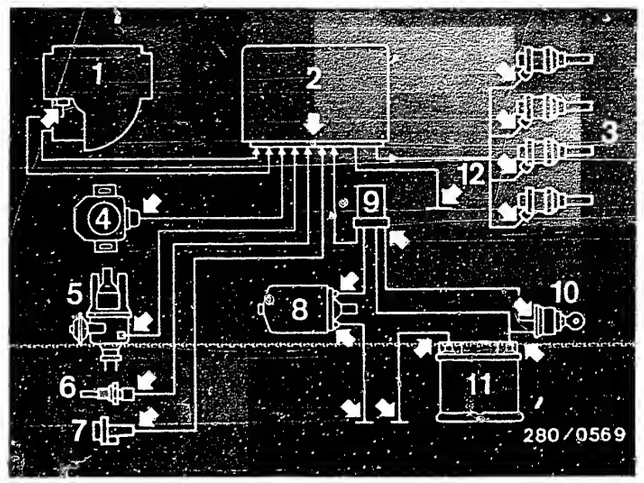
The universal test adapter tests only the peripherals of the electrics (not including control unit).
Disconnect control-unit plug of Jetronic wiring harness from control unit and connect to plug of adapter lead (ignition must be off).
To make the readings, connect a multimeter to the universal test adapter for voltage and resistance measurements, as well as a motortester.
The individual test steps are selected by means of two program switches (one for voltage measurements, the other for resistance measurements). Each program switch has 24 test settings, only some of which, however, are used for the LU-Jetronic.
The test with the universal test adapter must always be performed from the beginning to end, starting at test step 1, and in the given sequence.
Be sure to follow the instructions in the test chart!

* Test steps 1...3 measure voltages during starting.
  Set multimeter to "voltage measuring range".
* Test steps 4...10 measure resistances.
  Set multimeter to "resistance measuring range".

Test specifications and notes on how to operate the universal test adapter are given in the following test chart.
Requirements for correct testing procedure:

1. The trouble-shooting in each test step builds on the trouble-shooting of the preceding test step.
   Example: If, in test step 1, the ground connect term. 5 for the control unit is checked, this is not repeated in the following test steps.
2. If an incorrect reading is indicated for a test step, this test step must be repeated after the fault has been remedied.

Note:
In the following test steps, a frame is drawn around certain passages of text to indicate which operation has to be changed compared with the preceding test step.



Electrical plug-in connections (Arrows)
1=Air-flow sensor
2=Control unit
3=Injection valves
4=Throttle-valve switch
5=Ignition distributor
6=Temperature sensor II (engine)
7=Auxiliary-air device
8=Electric fuel pump
9=Control relay
10=Ignition lock
11=Battery
12=Central ground

TEST STEP 1 (TEST SPECIFICATIONS AND NOTES ON OPERATION)

V

Component / Function:
Signal from term. 1 of ignition system. Triggering of control unit.

* Operation: Setting
  Progr. switch " V " 5
  Progr. switch " Ω " 1)
  Test button
  1)Switch setting optional.
* Measuring equipment:
  Ignition oscilloscope

* Measuring range:
  Special input
  Control lever at left-hand stop
  Measuring range 20 V
* Connection:
  Test wells

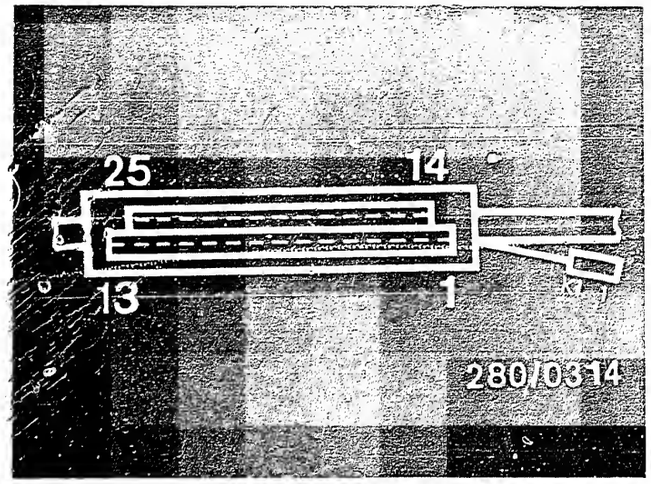
* Operation in vehicle:
  Ignition "on" and start

* Test specifications (reading):
  Ignition pulses

Are ignition pulses present?

N>

* Trouble-shooting:
  For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.
  Check the following leads for continuity with ohm-meter (specification 0 Ω):
+ From control-unit plug term. 1 to ignition coil term. 1
+ From control-unit plug term. 5 to central ground
+ Eliminate contact resistances at the plug-in connections.



Top view of control-unit plug

Y

V

Continued on next coordinate

Installation position of components:

* Control unit:
  In passenger compartment, front-passenger side, in footwell at bottom right.
* Central ground:
  On valve cover at rear right, near auxiliary-air device.

B09 ==> B10 <==>

TEST STEP 2 (TEST SPECIFICATIONS AND NOTES ON OPERATION)

V

Component/Function:
Control unit power supply from term. 87 of control relay.

* Operation:	Setting
Progr. switch " V "	6
Progr. switch " Ω "	____
Test button	____

* Measuring equipment:
Motortester/multimeter

* Measuring range:
0 ... 15 V

* Connection:
Red test socket (+)
Black test socket (−)

* Operation in vehicle:
Ignition "ON" and start

* Test specification (reading):
8...15 V

Is reading within test specification tolerance?

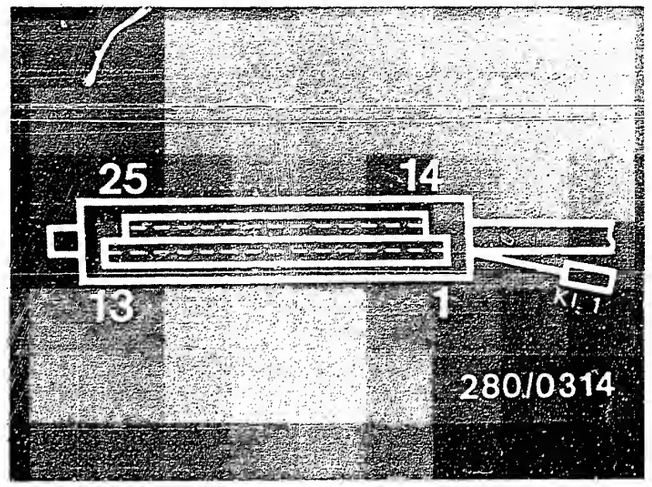
N>

* Trouble-shooting:
For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

Check the following leads for continuity with ohmmeter (set value approx. 0 Ω):
* From control-unit plug term. 9 to control relay term. 87

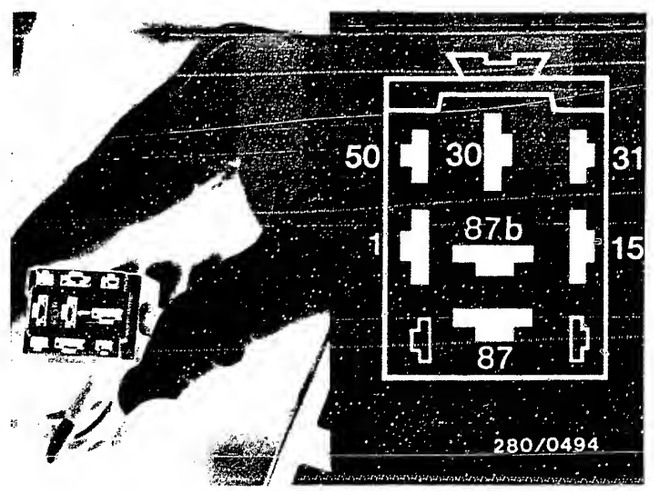
For further testing, disconnect battery!
+ From control relay term. 30 to battery (positive terminal).
+ From control relay term. 15 to ignition term. 15.
+ From control relay term. 50 to starting motor term. 50.
+ From control relay term. 31 to central ground.
+ Eliminate contact resistances at plug-in connections.

If still no voltage reading -> replace control relay.



Top view of control-unit plug

Control relay disconnected.
Top view of plug.



Installation position of components:

* Control unit:
In passenger compartment, front-passenger side, in foot-well at bottom right.
* Control relay:
In engine compartment on

V

Continued on next coordinate

TEST STEP 3 (TEST SPECIFICATIONS AND NOTES ON OPERATION)

V

Component / Function:
Starting signal at control unit from term. 50 of ignition and starting switch.

* Operation:	Setting
Progr. switch " V "	7
Progr. switch " Ω "	
Test button	

* Measuring equipment
Motortester/multimeter

* Measuring range:
0 ... 15 V

* Connection:
Red test socket (+)
Black test socket (−)

* Operation in vehicle:
Ignition "ON" and start

* Test specification (reading):
8...15 V

Is reading within test specification tolerance?

N>

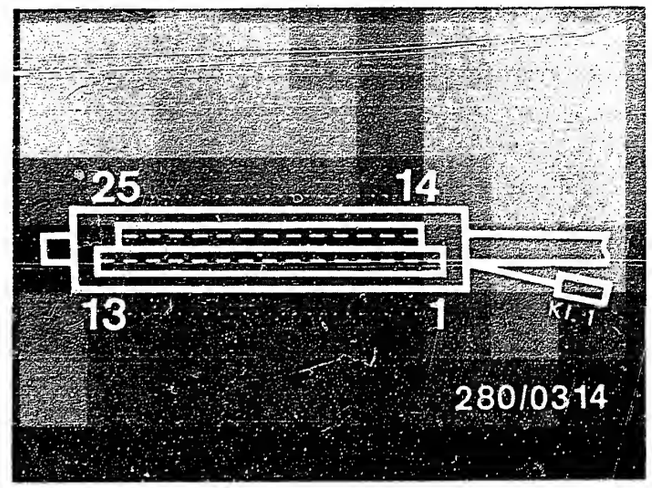
* Trouble-shooting:
For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

Check the following leads for continuity with ohmmeter: (set value approx. 0 Ω)

+ From control-unit plug term. 4 to control relay term. 50

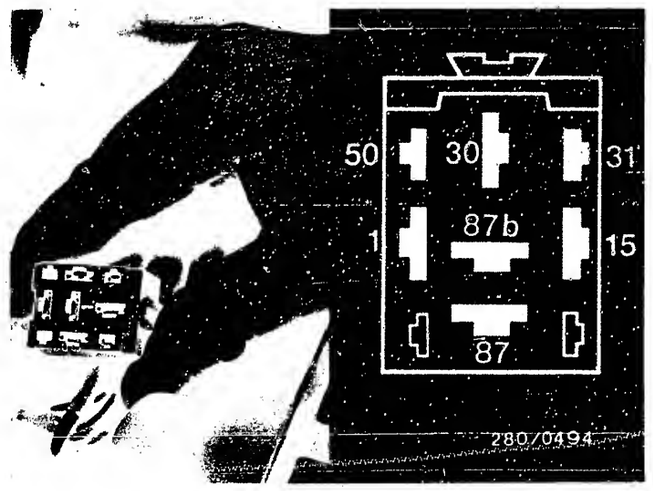
+ Eliminate contact resistances at the plug-in connections.

If still no voltage reading -> check starting system.



Top view of control-unit plug

Control relay disconnected.
Top view of plug.



Installation position of components:

* Control unit:
In passenger compartment, front-passenger side, in foot-well at bottom right.
* Control relay:
In engine compartment on

V

Continued on next coordinate

TEST STEP 4 (TEST SPECIFICATIONS AND NOTES ON OPERATION)

V

Component/Function:
Resistance between air-flow sensor term. 8 and central ground.

* Operation:	Setting	
Progr. switch	" V "	==>
Progr. switch	" Ω "	11
Test button		—

* Measuring equipment
Motortester/multimeter

* Measuring range:

x 10 Ω

* Connection:
Blue test sockets

* Operation in vehicle:
not applicable

* Test specification (reading):
100...200 Ω

Is reading within test specification tolerance?

N>

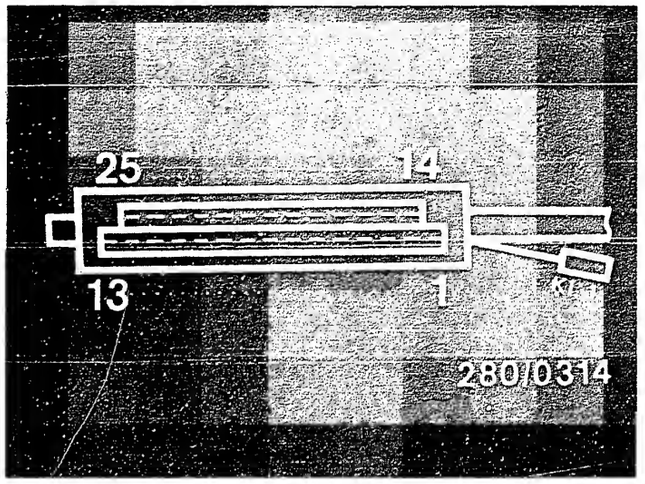
* Trouble-shooting:
For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

Check the following leads for continuity with ohmmeter (set value approx. 0 Ω):

1. Electric fuel pump:
+ From control relay term. 87b via pump fuse to electric fuel pump (positive terminal).
+ From electric fuel pump (negative terminal) to ground connection on body.

2. Air-flow sensor:
+ From control-unit plug term. 8 to air-flow sensor term. 8.
+ From air-flow sensor term. 5 to central ground.
+ From air-flow sensor term. 9 to control-unit plug term. 9.
+ Eliminate contact resistances at the plug-in connections.

If resistance reading still not within tolerance -> replace air-flow sensor.



Top view of control-unit plug

Y

V

Continued on next coordinate

Installation position of components:

* Electric fuel pump:
Under vehicle, to right of fuel tank.
* Air-flow sensor:
In injection compartment in front of right-hand spring strut.
* Central ground:
On valve cover, at rear right.
* Pump fuse:
In central fuse box on left under steering wheel.

TEST STEP 5 (TEST SPECIFICATIONS AND NOTES ON OPERATION)

V

Component/Function:
Resistance between air-flow sensor term. 7 and central ground.

* Operation:	Setting	
Progr. switch " V "		⟹
Progr. switch " Ω "		12
Test button		—

* Measuring equipment
Motortester/multimeter

* Measuring range:
x 10 Ω

* Connection:
Blue test socket

* Operation in vehicle:
Fully deflect sensor flap.

* Test specification (reading):
60...1000 Ω

Is reading within test specification tolerance?

N>

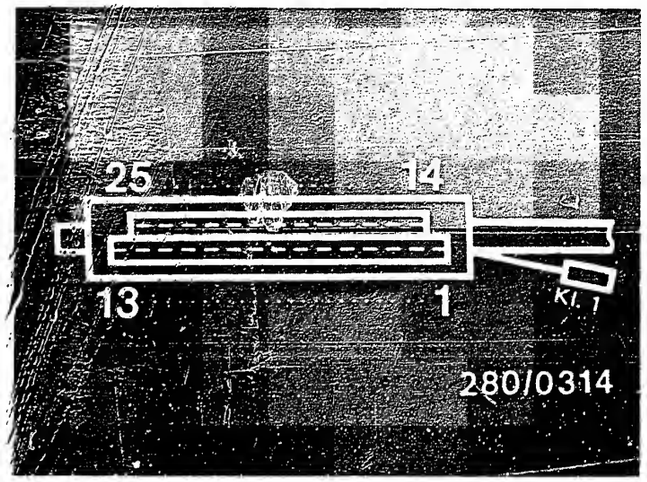
* Trouble-shooting:
For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

Check the following leads for continuity with ohmmeter (Set value approx. 0 Ω):

+ From control-unit plug term. 7 to air-flow sensor term. 7.

+ Eliminate contact resistances at the plug-in connections.

If resistance reading still not within tolerance -> replace air-flow sensor.



Top view of control-unit plug

Y

V

Continued on next coordinate

Installation position of components:

* Control unit: In passenger compartment, front-passenger side, in footwell at bottom right.

Air-flow sensor:
In engine compartment in front of right-hand spring strut.

TEST STEP 6 (TEST SPECIFICATIONS AND NOTES ON OPERATION)

V

Component/Function:
Resistance between temperature sensor II (engine) term. 10 and central ground.

* Operation:	Setting
Progr. switch " V "	⟹
Progr. switch " Ω "	13
Test button	—

* Measuring equipment
Motortester/multimeter

* Measuring range:
x 10 Ω or x 100 Ω

* Connection:
Blue test socket

* Operation in vehicle:
not applicable

* Test specification (reading):
at ambient temperature (+15° C...+30° C):
1,45...3,3 k Ω

with engine at op. temp. (approx +80° C):
280...360 Ω

Is reading within test specification tolerance?

Y

V

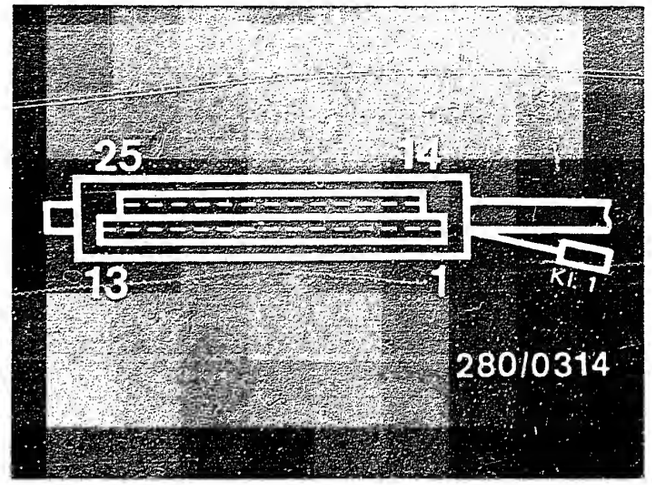
Continued on next coordinate

N>

* Trouble-shooting:
For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

Measure resistance directly at engine temperature sensor II (blue plug).
Ambient temperature (+15°C...30°C)
1,45...3,3 k Ω
Engine at op. temp. (+80°C)
280...360 Ω

Check the following leads for continuity with ohmmeter (specification approx 0 Ω):
+ From control-unit plug term. 10 to temperature sensor II (engine) term. 10.
+ Lead 38 from temperature sensor II to central ground.
+ Eliminate contact resistances at the plug-in connections.



Top view of control-unit plug

Installation position of components:

* Temperature sensor II (engine)
On engine block at rear right (blue plug).
* Central ground:
On valve cover, at rear right.
* Control unit:
In front-passenger footwell at bottom right.

TEST STEP 7 (TEST SPECIFICATIONS AND NOTES ON OPERATION)

V

Component/Function:
Ground connection of output stage, control unit term. 13.

* Operation:	Setting
Progr. switch " V "	⟹
Progr. switch " Ω "	14
Test button	—

* Measuring equipment
Motortester/multimeter

* Measuring range
x 1 Ω

* Connection:
Blue test sockets

* Operation in vehicle:
not applicable

* Test specification (reading)
0...10 Ω

Is reading within test specification tolerance?

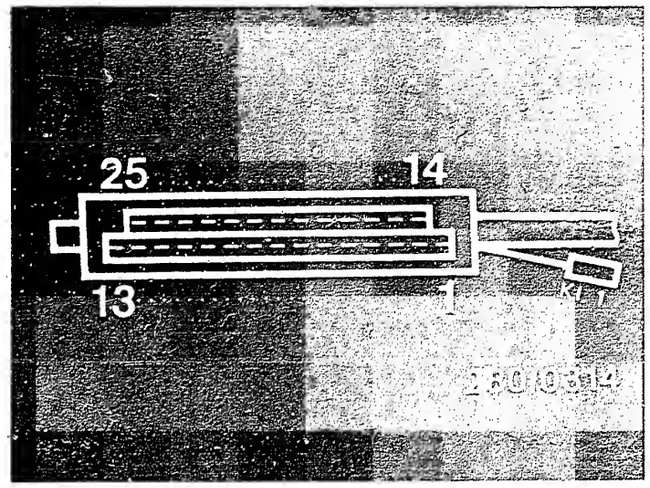
N>

* Trouble-shooting:
For testing, disconnect control-unit plug and use circuit diagram if necessary.

Check the following leads for continuity with ohmmeter (set value approx. 0 Ω):

+ From control-unit plug term. 13 to central ground.

+ Eliminate contact resistances at the plug-in connections.



Top view of control-unit plug

Y

V

Continued on next coordinate

Installation position of components:

* Control unit:
In passenger compartment, front-passenger side, in footwell at bottom right.
* Central ground:
On valve cover at rear right, near auxiliary-air device.

B21 — ⟺

B22 — ⟺

TEST STEP 8 (TEST SPECIFICATIONS AND NOTES ON OPERATION)

V

Component/Function:
Idle contact of throttle-valve switch term. 2

* Operation:		Setting
Progr. switch	* V *	⟹
Progr. switch	* Ω *	16
Test button		—

N>

* Measuring equipment
Motortester/multimeter

* Measuring range:
x 1 Ω

* Connection:
Blue test sockets

* Operation in vehicle:
Accelerator in rest position

* Test specification (reading):
0...10 Ω

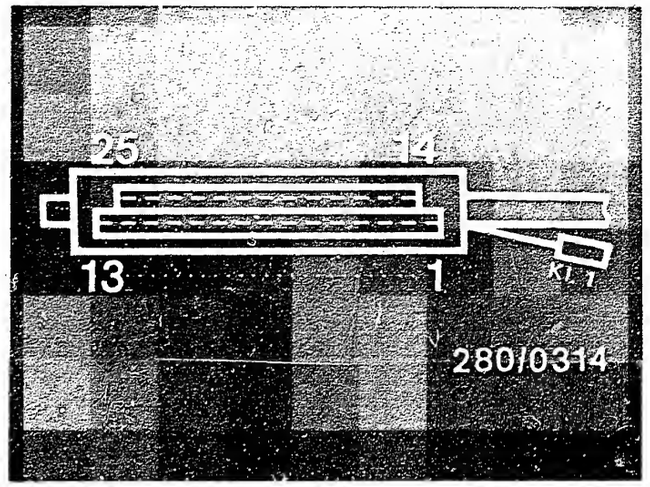
Is reading within test specification tolerance?

Y

V

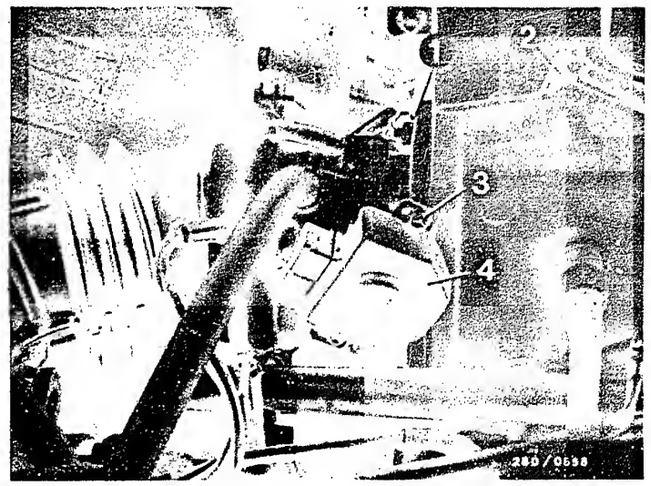
Continued on next coordinate

* Trouble-shooting:
For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.
Adjusting the throttle-valve switch (on intake manifold at front)
Slightly loosen fastening screws. Connect ohmmeter to throttle-valve switch between term. 2 and term. 18. Turn throttle-valve switch in a counterclockwise direction until the idle contact closes (microswitch clicks audibly).
Reading 0 Ω . If not -> replace throttle-valve switch.
Checking the adjustment:
Pull slightly on throttle cable. The idle contact opens (microswitch clicks audibly). Reading: infinity Ω .
Check the following leads for continuity with ohmmeter (specification approx 0 Ω):
+ From control-unit plug term. 2 to throttle-valve switch term. 2.
+ From throttle-valve switch term. 18 to control-unit plug term. 9.
+ Eliminate contact resistances at the plug-in connections.



Top view of control-unit plug

1 = Throttle-valve stop screw
2 = Throttle lever
3 = Fastening screws
4 = Throttle-valve switch



TEST STEP 9 (TEST SPECIFICATIONS AND NOTES ON OPERATION)

V

Component/Function:
Full-load contact of
throttle-valve switch term. 3

* Operation:	Setting
Progr. switch " V "	⟹
Progr. switch " Ω "	17
Test button	—

* Measuring equipment
Motortester/multimeter

* Measuring range:
x 1 Ω

* Connection:
Blue test sockets

* Operation in vehicle:
Accelerator fully depressed

* Test specification (reading):
0...10 Ω

Is reading within test
specification tolerance?

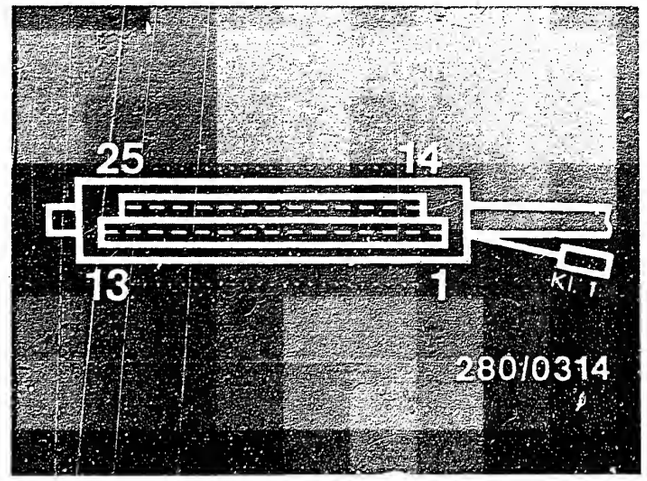
N>

* Trouble-shooting:
For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.

Check the following leads for continuity with ohmmeter (set value approx. 0 Ω):

+ From control-unit plug term. 3 to throttle-valve switch term. 3.

+ Eliminate contact resistances at the plug-in connections.



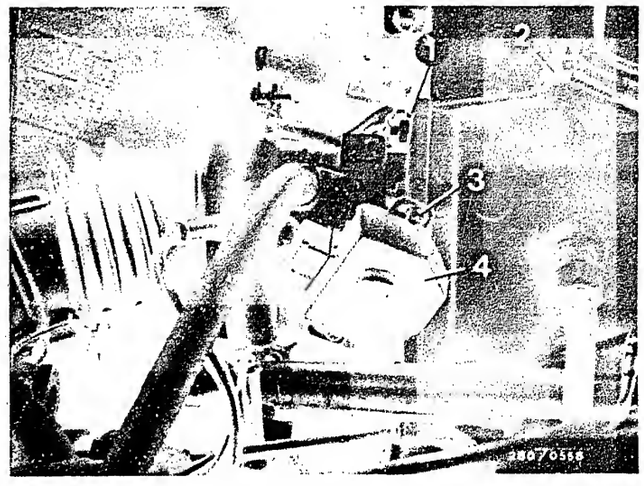
Top view of control-unit plug

Y

V

Continued on next coordinate

1 = Throttle-valve stop screw
2 = Throttle lever
3 = Fastening screws
4 = Throttle-valve switch



TEST STEP 10 (TEST SPECIFICATIONS AND NOTES ON OPERATION)

V

Component / Function:
Resistance of all solenoid-operated injection valves (4 in parallel) term. 2

* Operation:	Position
Progr. switch V	==>
Progr. switch Ω	18
Test button	—

* Measuring equipment:
Motortester or multimeter

Mearuring range:
x 1 Ω

Connection:
Blue test sockets

* Operation in vehicle:
not applicable

* Test specifications (reading):
at
+15°...+30°C: 7,0...9,5 Ω
at +80°C: 7,2...10,0 Ω

Is reading within test-specifications tolerance?

N>

Y

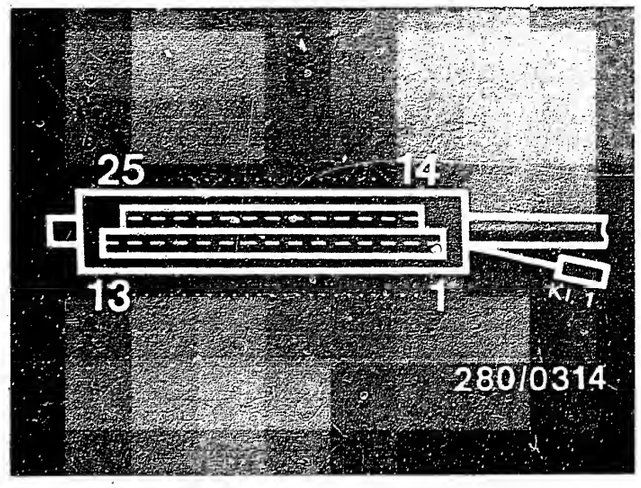
V

Test with universal test adapter now completed.

Now perform the fuel pressure test.
On the following coordinates.

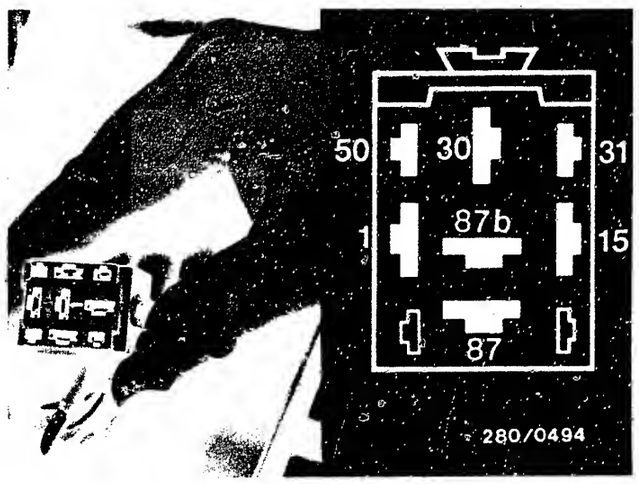
* Trouble-shooting:
For testing, disconnect control-unit plug from test adapter and use circuit diagram if necessary.
Check the following leads for continuity with ohm-meter (specification approx 0 Ω):
+ From control-unit plug term. 12 to the injection valves.
+ From the injection valves to control relay term. 87.
+ Resistance measurement at individual injection valves:
At ambient temperature (+15°C...+30°C): 15...17,5 Ω
With engine at op. temp. (approx.+80°C): 17...20,0 Ω
If reading too high: open circuit in valve coil or a valve connector has dropped off.
Check contacts for security.
Eliminate contact resistances.
If necessary, replace injection valve(s).

Installation position of components:
* Injection valves: In the individual intake ports.
* Control relay: In engine compartment on left-hand spring strut crown.



Top view of control-unit plug

Control relay disconnected.
Top view of plug.



Fuel pressure test

V

Is the electric fuel pump running? (Check by listening)

* Lead from ignition coil term. 1 O.K.?
* Voltage present at term. 87b and electric fuel pump?
* Pump fuse O.K.?
* Ground cable O.K.?

N>

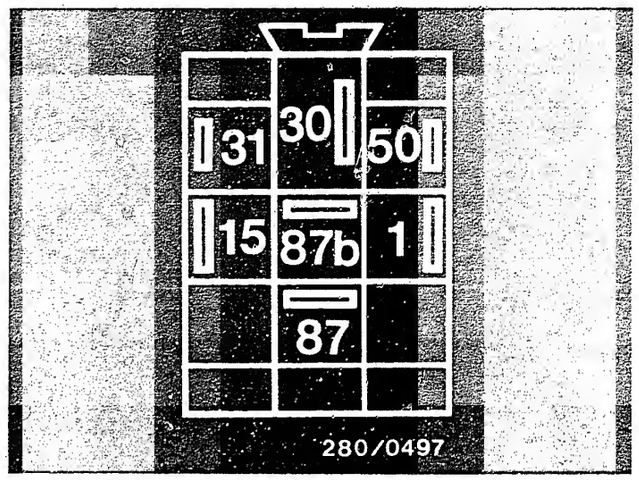
Check the control relay

With the connection base turned round and with the control relay connected:

* At term. 30 Battery voltage
  At term. 15 Electrical-system voltage with ignition "ON".
  At term. 50 Electrical-system voltage when starting.
  At term. 1 Voltage pulses from ignition coil term. 1
  At term. 31 Vehicle ground.
  Start engine.

* If no voltage at term. 87b, replace control relay.

* Pump fuse, on left under steering wheel, O.K.? If not -> replace.
* Voltage at terminals of electric fuel pump min. 12 V. If not -> check ground lead.
  If yes -> replace electric fuel pump.



Back of control relay connection base

Y

Fuel pressure O.K.?
Pressure regulator O.K.?

Test specification: 2,3...2,7 bar

Test specification obtained?

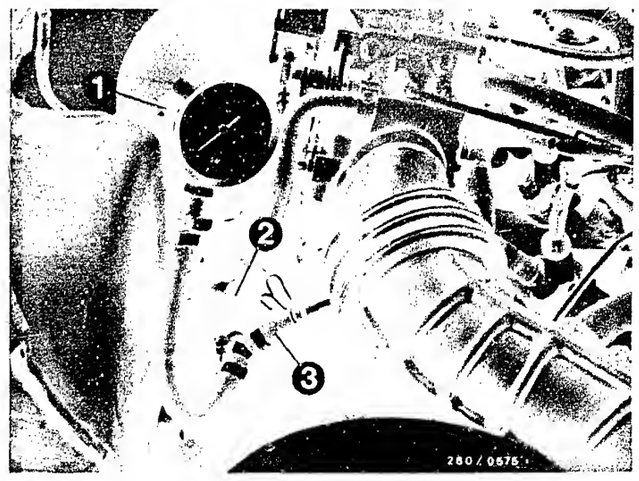
N>

Checking the fuel pressure

* Connect pressure gauge or pressure tester to inlet of fuel-distribution pipe.
  Use three-way line KDJE-P-100/13.

C A U T I O N !
When disconnecting the fuel hose, make sure that no fuel gets onto hot parts of the engine.

1 = Pressure gauge
2 = Fuel delivery line from fuel filter
3 = Delivery line to fuel-distribution pipe



Y

V

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V

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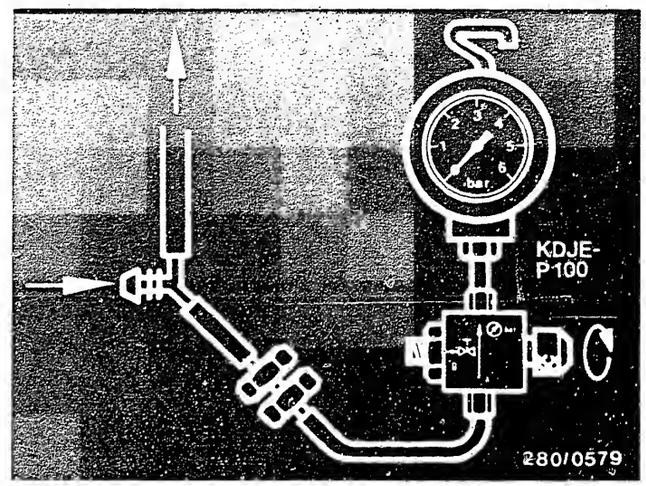
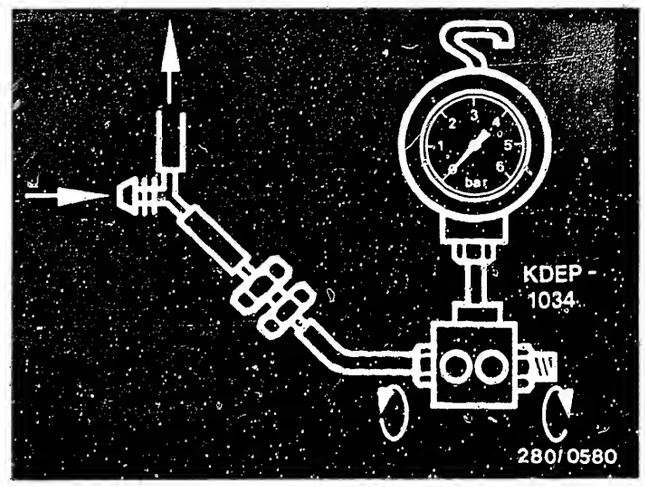
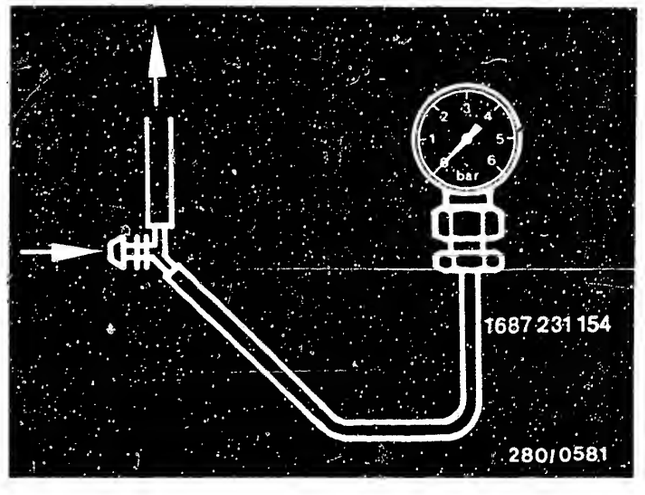
Checking the fuel pressure (continued 1)

Connect connections of pressure tester into the fuel-delivery line. If using pressure tester KDJE-P 100, close the valve screw (only the right-hand screw on KDEP 1034). The end of the hose is connected to the fuel-distribution pipe; the free Y-piece connection is connected to the fuel-delivery hose.

Make sure there are no leaks.







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Checking the fuel pressure (continued 2)

V

Jumping the safety circuit.
Disconnect control relay. Connect jumper into connection base between term. 87b and term. 30. Electric fuel pump must operate.

Fuel pressure
Test specification: 2,3..2,7 bar

C A U T I O N !
Remove jumper and connect control relay. Let engine idle:
fuel pressure approx. 2.0 bar.

V

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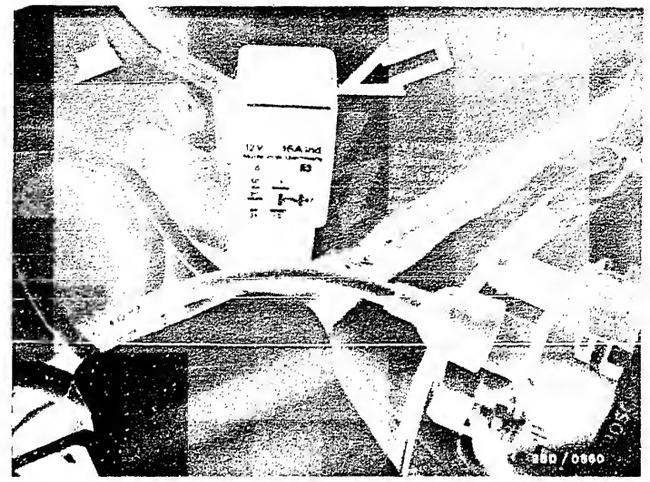
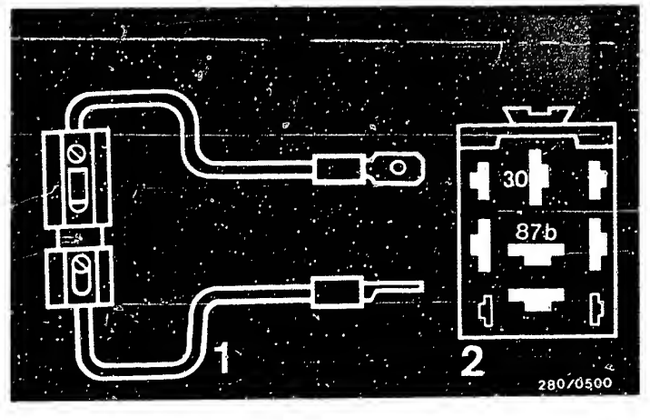


Arrow = Control relay on left-hand spring strut crown

1 = Jumper with fuse holder and 10 A fuse (user-fabricated)

2 = Top view of connection base



V

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Checking the fuel pressure (continued 3)

Test pressure regulator
Fuel pressure
Test specification: 2,3...2,7 bar

Fuel pressure of 2,3 bar not reached:

* Slowly pinch off fuel return line.
  C A U T I O N :
  Do not load pressure gauge above 6 bar.
  If pressure rises above 4 bar - replace pressure regulator.
  The fuel-pressure regulator is attached to the fuel-distribution pipe by a hose piece.

* Fuel delivery line, fuel filter or pressure damper clogged.

* Strainer in tank clogged.

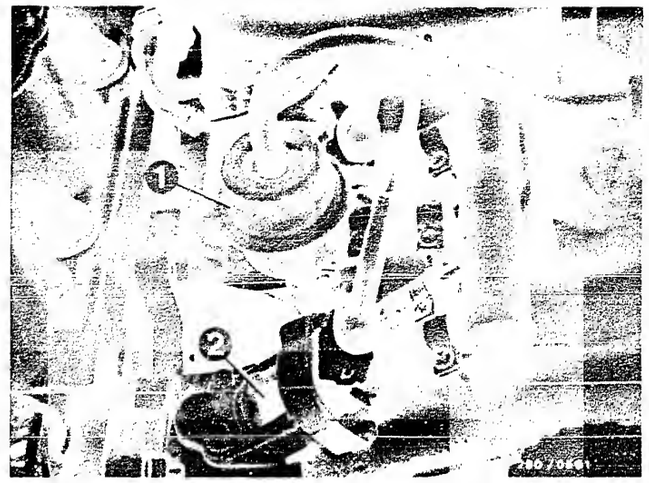
* Corrosion in tank.

Fuel pressure of 2,7 bar exceeded:

* Fuel return line clogged or pinched.

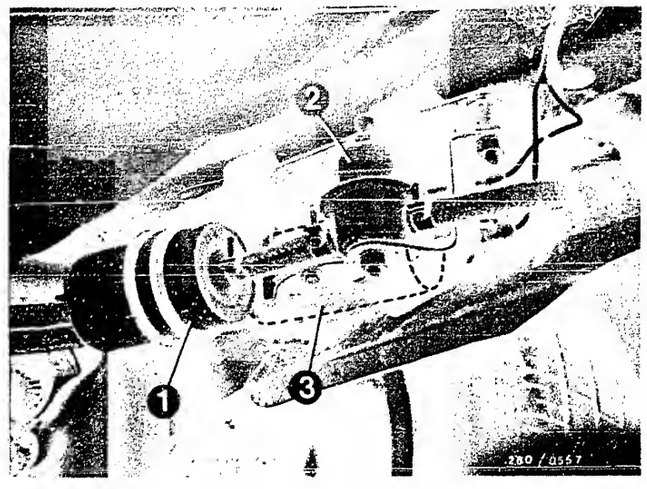
* Replace pressure regulator.

C A U T I O N !
It is essential to remove the jumper after testing is complete and to reconnect the control relay.



1 = Pressure regulator
2 = Injection valve

1 = Fuel filter
2 = Pressure damper
3 = Electric fuel pump (partially hidden in picture)



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Checking the fuel pressure (continued 4)

Does fuel pressure remain almost constant after engine has been switched off?

Test specification: 2,3...2,7 bar

Is test specification still obtained after 20 min.?

N>

The fuel pressure drops quickly after the hot engine has been switched off.

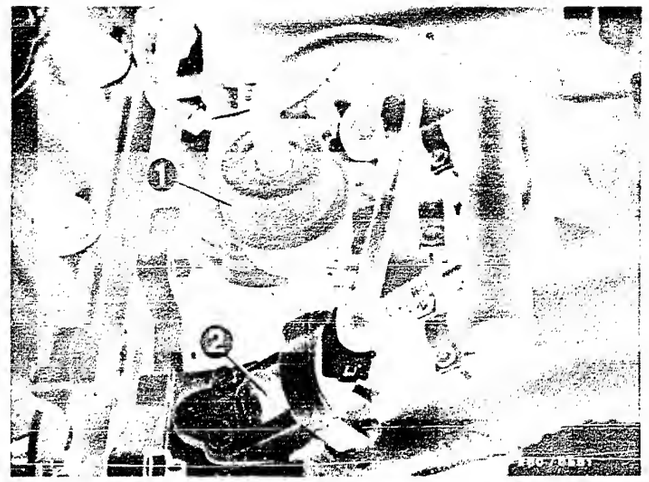
* Check fuel system for leaks:
- Jump the safety circuit
- Fuel pressure 2,3...2,7 bar
- Disconnect jumper and observe pressure gauge. After approx. 20 min. the fuel pressure must still be min. 1.0 bar.

If not:

* Check joints between components, fuel hoses and fuel lines for leaks.
* Pressure regulator (diaphragm)
* Solenoid-operated injection valves (needle seat, valve not closing properly).
* Electric fuel pump (non-return valve leaking)
* Pressure damper or fuel filter leaking.

Remove pressure gauge. Re-establish connection between fuel delivery line and fuel-distribution pipe. Remove jumper and connect control relay in connection base. The fuel pressure test is completed.
If the fault has not been found or if further instructions are required on how to remedy the fault, continue with the trouble-shooting chart of your choice.

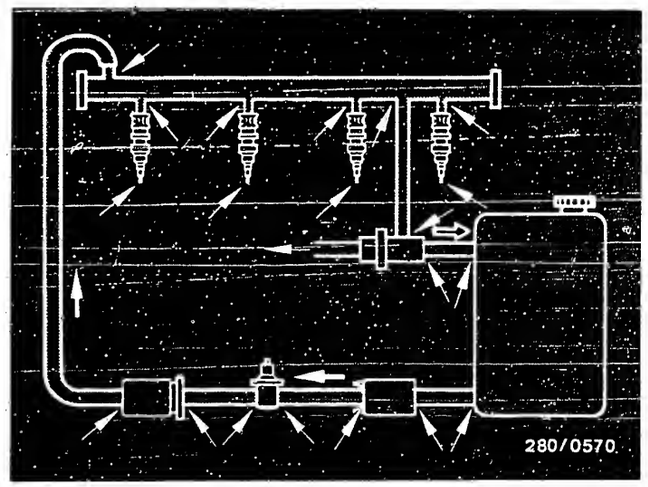
The detailed trouble-shooting chart is on Coordinates B3...B4 and the direct trouble-shooting chart on Coordinates B5...B6.



1 = Pressure regulator
2 = Injection valve

Diagram of fuel lines

Arrows indicate joints between hoses and components.



STARTING MOTOR OPERATES, ENGINE FAILS TO START OR STARTS ONLY WITH GREAT DIFFICULTY

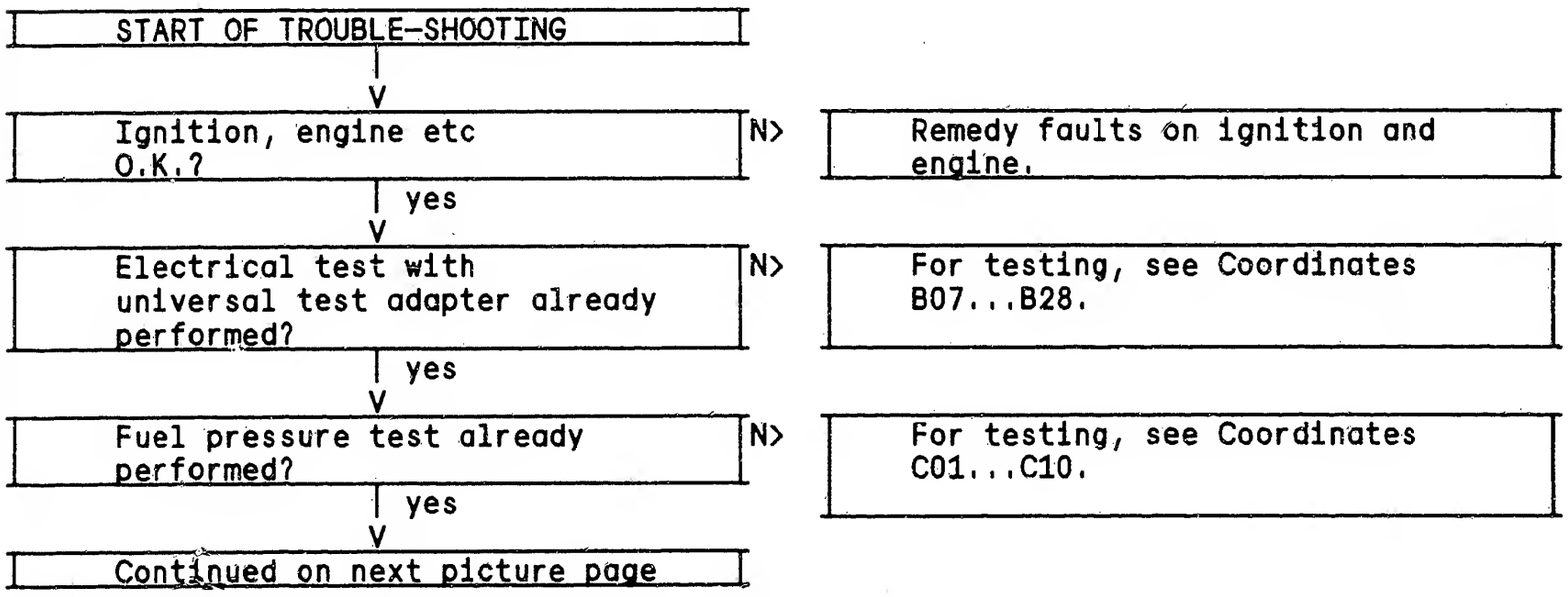
Trouble-shooting program according to customer complaints

Procedure

The test is divided into 3 rows of boxes:

* The left-hand row contains the questions for the tests.
* The center row describes the testing and adjusting operations on the components.
* The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be conclusively answered with "yes" without testing, proceed to the next question down.
If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there.
After testing, continue trouble-shooting at the point at which you branched off.



D01 ==> D02 <==>

Starting motor operates, engine fails to start (continued 1)

Cold-start control O.K.?
(Control unit function)

* Does voltage at injection valve drop during starting from approx 7 V to approx 0.5 V? (< 0.5 V if engine at operating temperature)

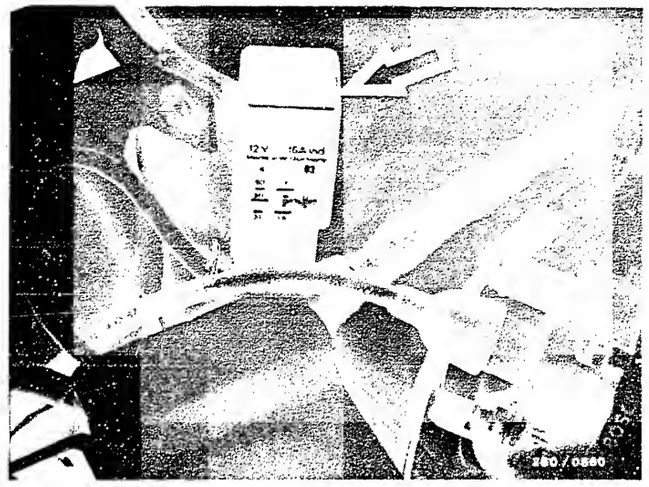
N>

Functional test:

* Disconnect control relay.
* Connect jumper into connection base between term. 30 and term. 87. (Power supply to control unit and to injection valves).

Continued on next picture page

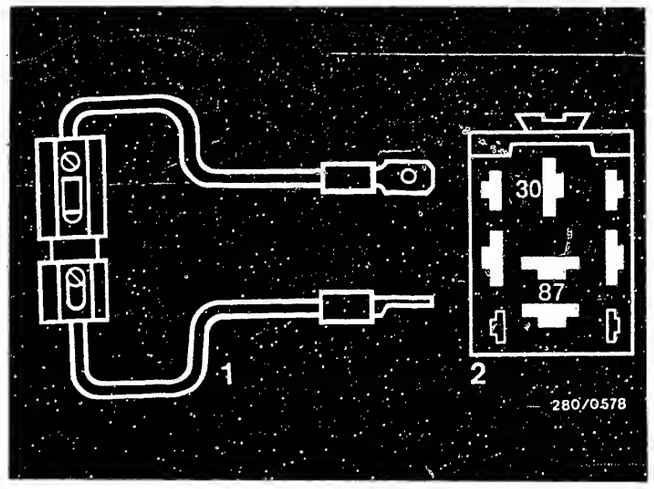
Continued on next picture page



Arrow = Control relay on left-hand spring strut crown

1 = Jumper with fuse holder and 10 A fuse (user-fabricated)

2 = Top view of connection base

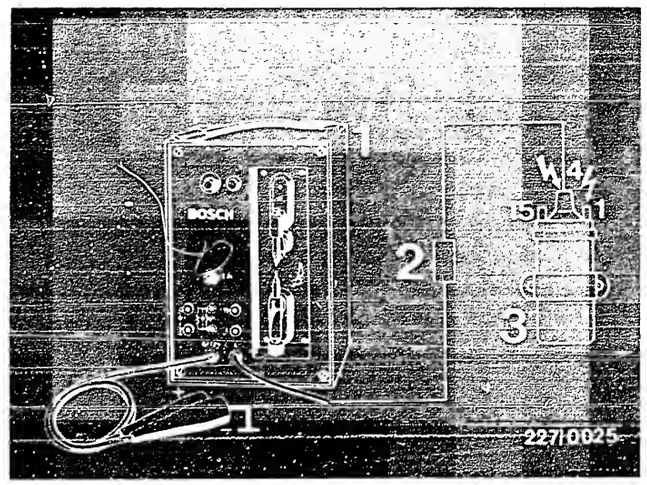


Starting motor operates, engine fails to start (continued 2)

V

* Disconnect ignition cable term. 4 from distributor cap and connect to vehicle ground with spark gap.
(Caution! Engine must not start).

Caution:
When using a spark gap, it is necessary – in order to prevent irreparable damage to the trigger box – to connect an interference-suppression resistor of at least 2 k Ω between spark gap and ignition coil term. 4., e.g. sleeve-type suppressor (5 k Ω) 0 356 500 001.



1 = Spark gap
2 = 5 k Ω sleeve-type suppressor
3 = Ignition coil
(Caution: term. 1 and term. 4: Dangerous voltages 400 V – 25 kV).

V

Continued on next picture page

V

Continued on next picture page

D05 — <⟹>

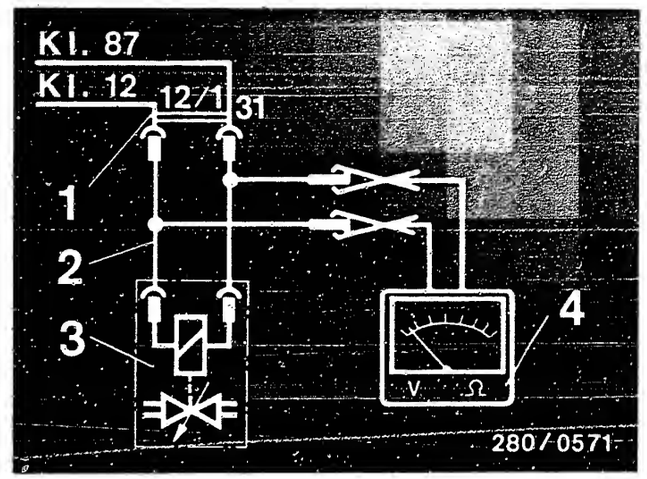
D06 — <⟹>

Starting motor operates, engine fails to start (continued 3)

V

* Connect 2-pole adapter lead 1 684 463 093 between an injection valve and its electric connecting lead.
* Connect multimeter to free measuring poles.
  Measuring range approx. 10 V.
* Disconnect plug from temperature sensor II (engine) (blue plug).

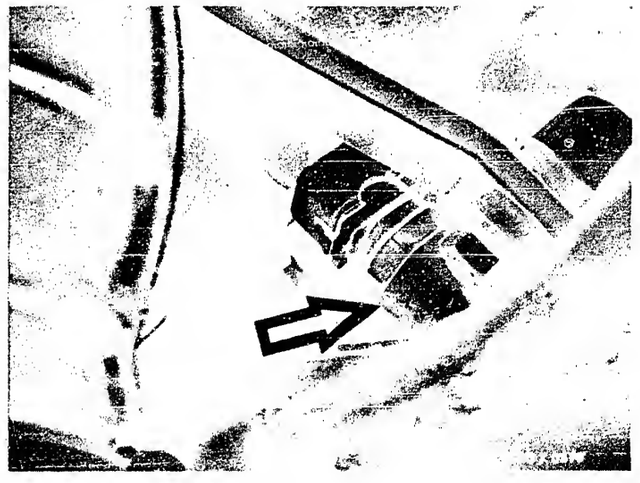
MEASUREMENT:
* Start engine.
* Voltage reading drops within approx. 15 s cranking time from initially approx. 7 V to approx. 0.5 V.
  If voltage readings not obtained – replace control unit.
* Wait for longer than 1 minute before cranking again.
* Connect plug to temperature sensor. If engine at operating temperature, start – voltage reading less than 0.5 V.



1 = Valve lead connector
2 = Adapter lead
    1 684 463 098
3 = Injection valve
4 = Multimeter

Term. 87 = from control relay
Term. 12 = from control unit

Arrow=Temperature sensor II (engine) on engine block at rear right



V

Continued on next picture page

Starting motor operates, engine fails to start (continued 4)

Auxiliary-air device mechanically O.K.?
Free cross section:
* cold – open?
* warm – closed?
* Drop in engine speed when hose pinched off

N>

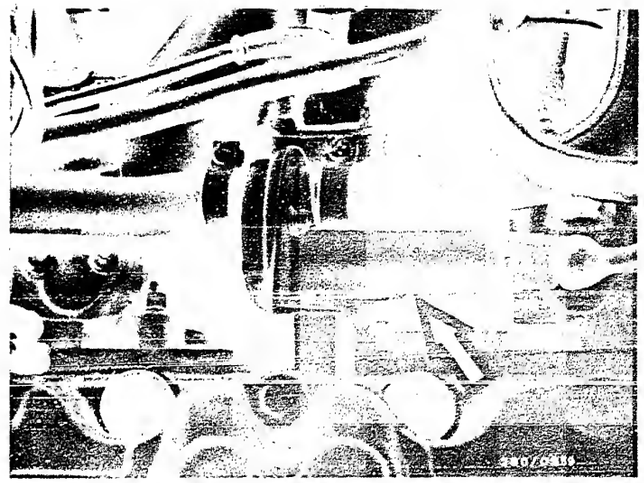
Checking the auxiliary-air device

* Visual examination

Disconnect hoses and look down (possibly using a small mirror). When cold, the cross section must be partially open; when the engine is warm, it must be closed. If not, replace auxiliary-air device.

* Functional test:

With the engine cold, pinch off hose to auxiliary-air device. Engine speed must drop. With engine warm, pinch off hose to auxiliary-air device. There must be no noticeable drop in engine speed. If not, replace auxiliary-air device (paying attention to direction of flow).



Arrow = Auxiliary-air device

Electrical operation of auxiliary-air device (power supply, ground lead, resistance) O.K.?

N>

Start engine.
* Voltage at plug at least 12 V. If not, check the following leads for continuity (set value approx. 0 Ω):
* From term. 26 to central ground
* From term. 9/2 to control relay term. 87.
* Resistance of auxiliary-air device 30...65 Ω (plug disconnected).
If resistance not within tolerance, replace auxiliary-air device.

Continued on next picture page

Starting motor operates, engine fails to start (continued 5)

Air-flow sensor mechanically and electrically O.K.?

* Sensor flap moving freely?
* Does sensor flap return to rest position?
* Resistances within tolerance?

Between term. 8 and term. 9:
160... 300 Ω

Between term. 7 and term. 5
(Deflect sensor flap fully):
60...1000 Ω

N>

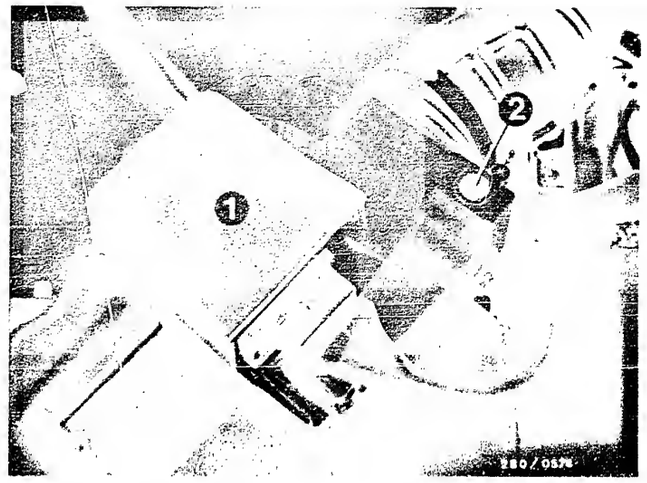
Testing:

* Unscrew air-flow sensor from air-flow filter housing. Open sensor flap by hand. It must be possible to open the sensor flap with uniform ease from its fully closed position to its fully open position. When released, it must close completely by itself. Sensor flap must not catch when opening. Watch for signs of rubbing or abrasion. Clean air-flow sensor if the inside is very dirty and rub out with a lint-free cloth. If there are signs of rubbing, replace air-flow sensor.

* Sensor flap must return to rest position. If not, the stopper or the sensor flap is bent. Replace air-flow sensor.

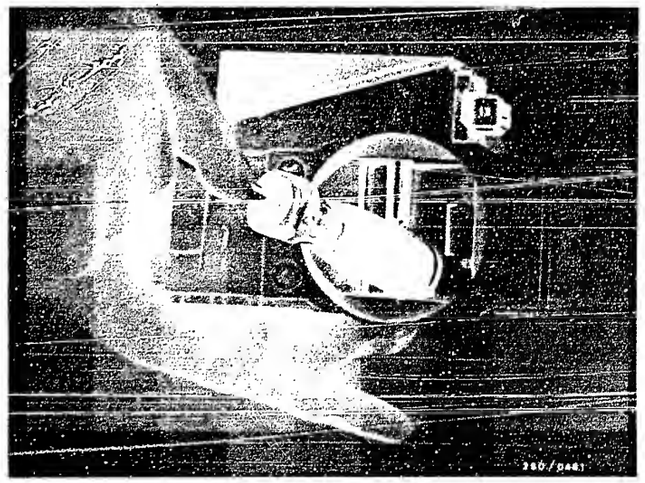
* Connect ohmmeter to term. 8 and term. 9 of air-flow sensor.
  Test specification: 160... 300 Ω
  Connect ohmmeter to term. 7 and term. 5 of air-flow sensor; deflect sensor flap.
  Test specification: 60...1000 Ω

C A U T I O N !
After testing is completed, the air-flow sensor must be screwed back onto the air-filter housing.



1 = Air-flow sensor
2 = CO adjusting screw

Opening the air-flow sensor flap



Continued on next picture page

Starting motor operates, engine fails to start (continued 6)

V

Are all hose lines correctly connected, not kinked or damaged?
Visual examination.

* Air-intake system checked for leaks with 0.3 bar gauge pressure?

N>

* Check whether hoses of air-[illegible] system and fuel-line system are correctly connected, not kinked or damaged. If necessary, replace hoses.
Eliminate leaks by means of new seals or by retightening the connecting screws.

* Leak test:
Seal off exhaust tail pipe. Unscrew air-flow sensor from air-filter housing and seal off air-flow sensor duct.
Disconnect hose after auxiliary-air device and, using a compressed-air gun, blow air (0.3 bar gauge pressure) into the intake manifold.
Seal off connection port on auxiliary-air device.
Open throttle valve fully while doing this.
Brush or spray all joints with soapy water.
Leaks may also occur at the following points on the engine:
Oil dipstick not securely inserted, defective lid seal on oil filler neck etc.
Bubbling or foaming indicates a leak.

Y

V

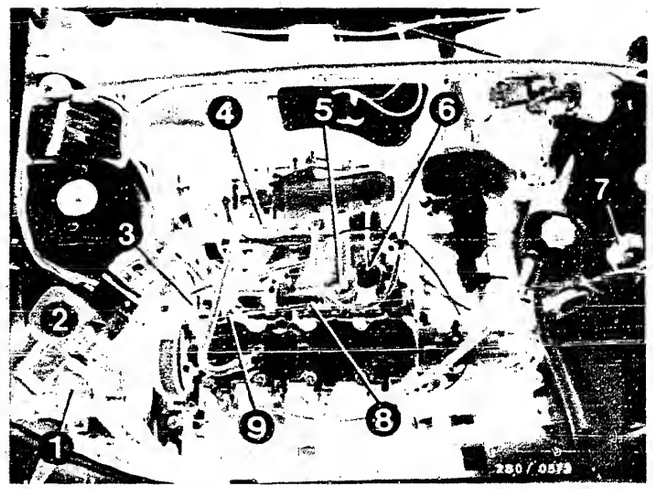
Trouble-shooting program for customer complaint

"starting motor operates, engine fails to start or starts only with difficulty"

completed.

If the fault has not been found or if further information is required on how to rectify the fault, continue with the trouble-shooting chart of your choice.

Detailed trouble-shooting chart coordinates B03/B04..
Direct trouble-shooting chart coordinates B05/B06..



1 = Air filter
2 = Air-flow sensor
3 = Temperature sensor II
4 = Throttle-valve switch
5 = Solenoid-op. inj. valves
6 = Pressure regulator
7 = Control relay
8 = Auxiliary-air device
9 = Central ground

ENGINE STARTS BUT THEN DIES

Trouble-shooting program according to customer complaints

Procedure

The test is divided into 3 rows of boxes:

* The left-hand row contains the questions for the tests.
* The center row describes the testing and adjusting operations on the components.
* The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be conclusively answered with "yes" without testing, proceed to the next question down.
If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there.
After testing, continue trouble-shooting at the point at which you branched off.

START OF TROUBLE-SHOOTING

Ignition, engine etc O.K.? — N> Remedy faults on ignition and engine.

yes

Electrical test with universal test adapter already performed? — N> For testing, see Coordinates B07...B28.

yes

Fuel pressure test already performed? — N> For testing, see Coordinates C01...C10.

yes

Continued on next picture page

E01 ⟹

E02 ⟺

Engine starts but then dies (continued 1)

V

Auxiliary-air device mechanically O.K.?
Free cross section:
* cold – open?
* warm – closed?
* Drop in engine speed when hose pinched off

N>

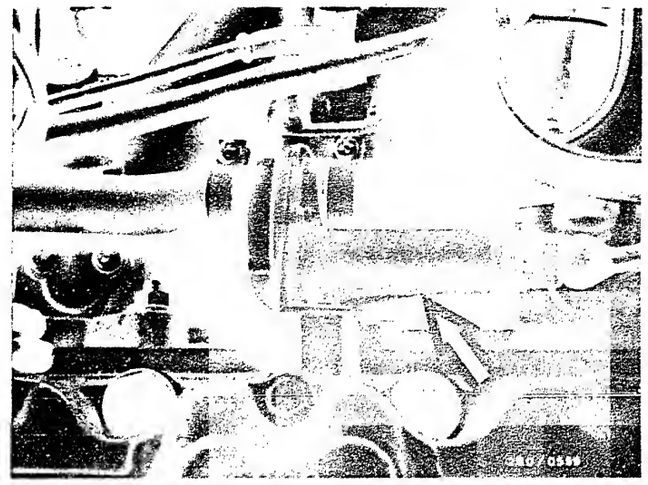
Checking the auxiliary-air device

* Visual examination

Disconnect hoses and look down (possibly using a small mirror). When cold, the cross section must be partially open; when the engine is warm, it must be closed. If not, replace auxiliary-air device.

* Functional test:

With the engine cold, pinch off hose to auxiliary-air device. Engine speed must drop. With engine warm, pinch off hose to auxiliary-air device. There must be no noticeable drop in engine speed. If not, replace auxiliary-air device (paying attention to direction of flow).



Arrow = Auxiliary-air device

Y

Electrical operation of auxiliary-air device (power supply, ground lead, resistance) O.K.?

N>

Start engine.
* Voltage at plug at least 12 V. If not, check the following leads for continuity (set value approx. 0 Ω):
* From term. 26 to central ground
* From term. 9/2 to control relay term. 87.
* Resistance of auxiliary-air device 30...65 Ω (plug disconnected). If resistance not within tolerance, replace auxiliary-air device.

Y

Continued on next picture page

Engine starts but then dies (continued 2)

Are all hose lines correctly connected, not kinked or damaged?
Visual examination.

* Air-intake system checked for leaks with 0.3 bar gauge pressure?

N>

* Check whether hoses of air-intake system and fuel-line system are correctly connected, not kinked or damaged. If necessary, replace hoses.
Eliminate leaks by means of new seals or by retightening the connecting screws.

* Leak test:
Seal off exhaust tail pipe. Unscrew air-flow sensor from air-filter housing and seal off air-flow sensor duct.
Disconnect hose after auxiliary-air device and, using a compressed-air gun, blow air (0.3 bar gauge pressure) into the intake manifold.
Seal off connection port on auxiliary-air device.
Open throttle valve fully while doing this.
Brush or spray all joints with soapy water.
Leaks may also occur at the following points on the engine:
Oil dipstick not securely inserted, defective lid seal on oil filler neck etc.
Bubbling or forming indicates a leak.

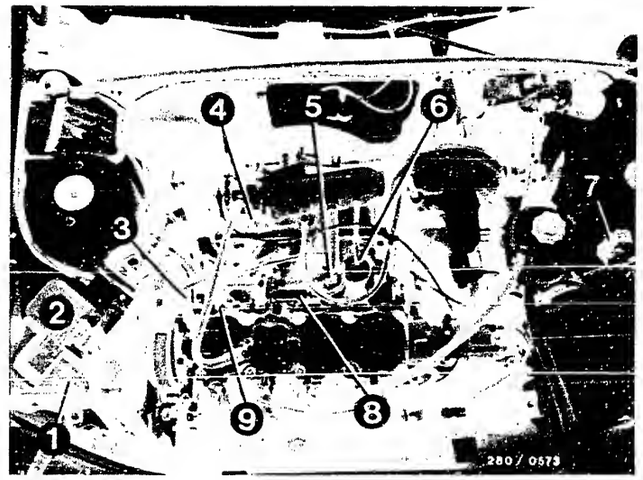
Trouble-shooting program for customer complaint

"engine starts but then dies"

completed.

If the fault has not been found or if further information is required on how to rectify the fault, continue with the trouble-shooting chart of your choice.

Detailed trouble-shooting chart coordinates B03/B04..
Direct trouble-shooting chart coordinates B05/B06..



1 = Air filter
2 = Air-flow sensor
3 = Temperature sensor II
4 = Throttle-valve switch
5 = Solenoid-op. inj. valves
6 = Pressure regulator
7 = Control relay
8 = Auxiliary-air device
9 = Central ground

ROUGH IDLE, INCORRECT IDLE SPEED

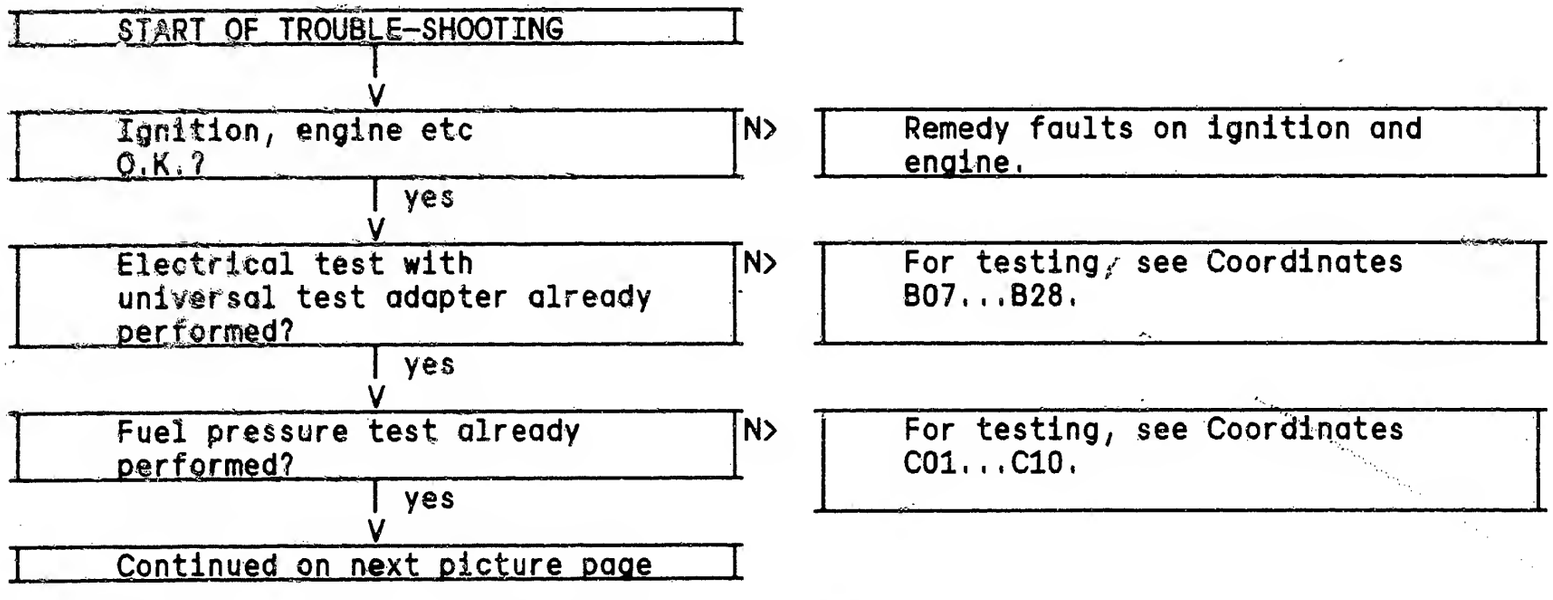
Trouble-shooting program according to customer complaints

Procedure

The test is divided into 3 rows of boxes:

* The left-hand row contains the questions for the tests.
* The center row describes the testing and adjusting operations on the components.
* The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be conclusively answered with "yes" without testing, proceed to the next question down.
If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there.
After testing, continue trouble-shooting at the point at which you branched off.



F01 ⟹

F02 ⟺

Rough idle, incorrect idle speed (continued 1)

Throttle valve closed?
Engine coughing on overrun?

* Does throttle lever come up against stop screw?
* Throttle cable free of tension?
* Throttle cable not kinked?

N>

* Testing:
Check whether the throttle valve can be closed still further and whether the engine speed thereby drops.

* Adjusting the throttle valve:
The throttle valve must come up against the stop screw with the throttle lever just before it sticks. Lock stop screw with lock nut.

* If throttle cable kinked – replace.

Y

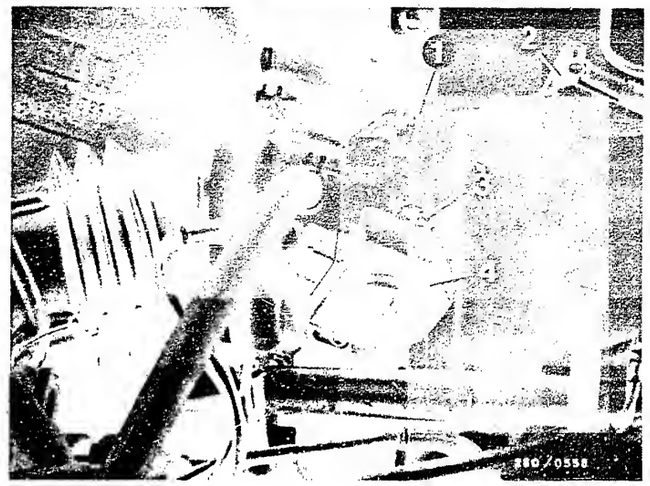
Throttle-valve switch correctly adjusted?
* Idle contact closing?
* Microswitch clicking audibly?

N>

* Adjustment
Loosen fastening screws slightly. Connect ohmmeter between term. 15 and term. 9/4. Turn throttle-valve switch in a counterclockwise direction until the idle contact closes (microswitch clicks audibly).
Reading: 0 Ω.
* Checking the adjustment:
Pull slightly on throttle cable. The idle contact opens (microswitch clicks audibly).
Reading infinity Ω.

Y

Continued on next picture page



1 = Throttle-valve stop screw
2 = Throttle lever
3 = Fastening screws
4 = Throttle-valve switch

Auxiliary-air device mechanically O.K.?
Free cross section:
* cold – open?
* warm – closed?
* Drop in engine speed when hose pinched off

N>

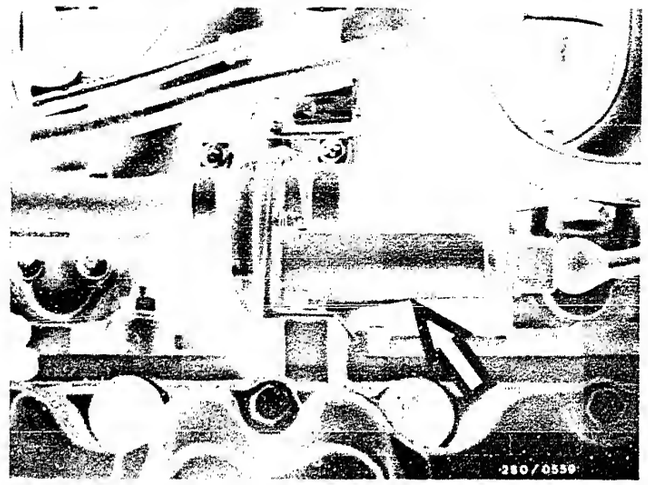
Checking the auxiliary-air device

* Visual examination

Disconnect hoses and look down (possibly using a small mirror). When cold, the cross section must be partially open; when the engine is warm, it must be closed. If not, replace auxiliary-air device.

* Functional test:

With the engine cold, pinch off hose to auxiliary-air device. Engine speed must drop. With engine warm, pinch off hose to auxiliary-air device. There must be no noticeable drop in engine speed. If not, replace auxiliary-air device (paying attention to direction of flow).



Arrow = Auxiliary-air device

Electrical operation of auxiliary-air device (power supply, ground lead, resistance) O.K.?

N>

Start engine.
* Voltage at plug at least 12 V.
  If not, check the following leads for continuity (set value approx. 0 Ω):
* From term. 26 to central ground
* From term. 9/2 to control relay term. 87.
* Resistance of auxiliary-air device 30...65 Ω (plug disconnected).
  If resistance not within tolerance, replace auxiliary-air device.

Continued on next picture page

Injection valves checked for correct operation?

* Injection pulse without interference or missing?

* Leads correctly routed?

* No loose contacts in plug-in connections?

N>

* Connect test lead as follows: Connect the two-pole plug connections of the test lead between a solenoid-operated injection valve and its connecting lead. Of the other two terminals of the test lead, only one terminal need be connected to the special input of the motortester.

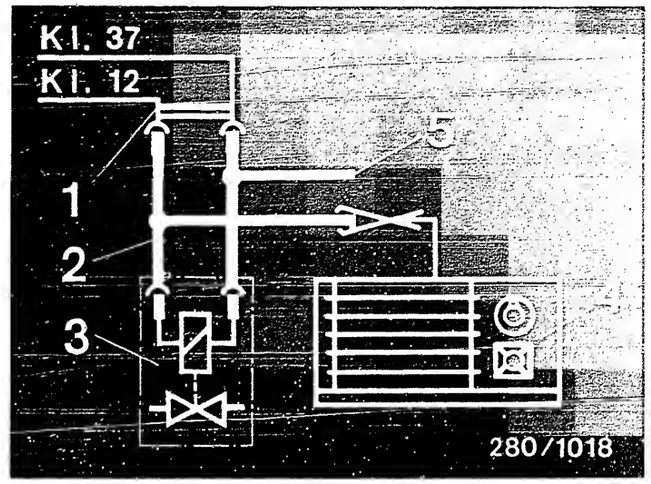
C A U T I O N !

The free terminal must not come into contact with the vehicle body.

* If correctly connected, the pattern shown opposite will be visible on the oscilloscope. With the aid of the test lead it is possible to check the injection pulses at the injection valves with an ignition oscilloscope with the engine running. If the pattern shown opposite is not obtained or if there are deviations (interference, missing etc), the other injection valves should also be examined.

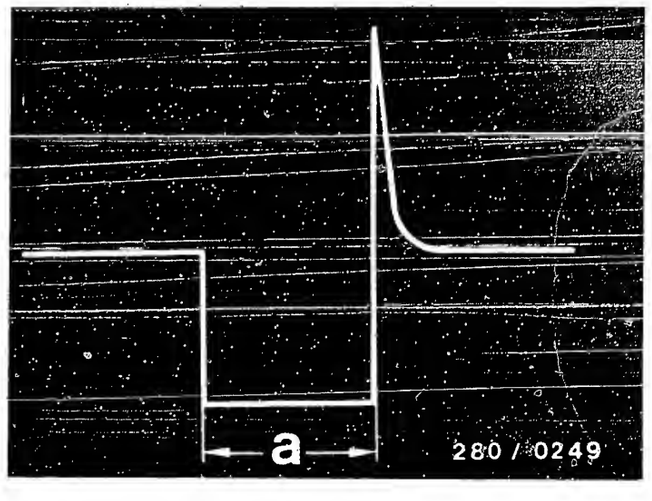
* In case of interference: check routing of leads.

* In case of missing: eliminate loose contacts in the leads or in the plug-in connections.



1 = Valve-lead connector
2 = Test lead 1 684 463 093
3 = Sol.-op- injection valve
4 = Motortester
5 = Free terminal (Do not bring into contact with ground)

a = Pulse length (dependent on engine load)



Continued on next picture page

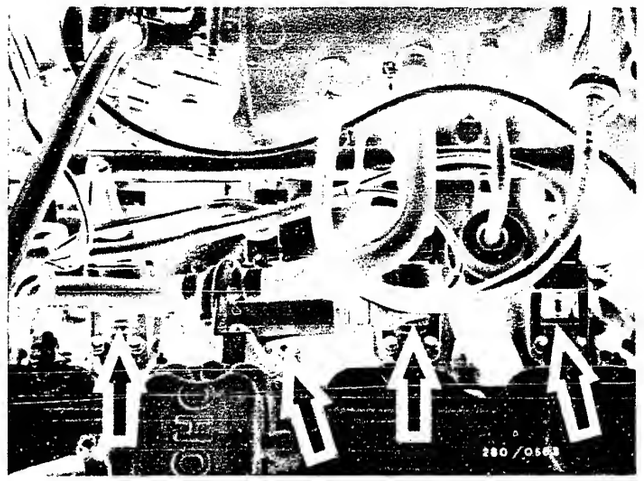
Rough idle, incorrect idle speed (continued 4)

V

Injection valve mechanically O.K.?
* Does engine speed drop when injection-valve connectors are pulled off?

N>

* With the engine running, disconnect injection-valve connectors individually, one after the other, from the injection valves and re-connect. Engine speed must drop if injection valve O.K.



Arrows = Injection valves

Y

V

Continued on next picture page

Air-flow sensor mechanically and electrically O.K.?

* Sensor flap moving freely?
* Does sensor flap return to rest position?
* Resistances within tolerance?

N>

Between term. 8 and term. 9:
160... 300 Ω

Between term. 7 and term. 5
(Deflect sensor flap fully):
60...1000 Ω

Y

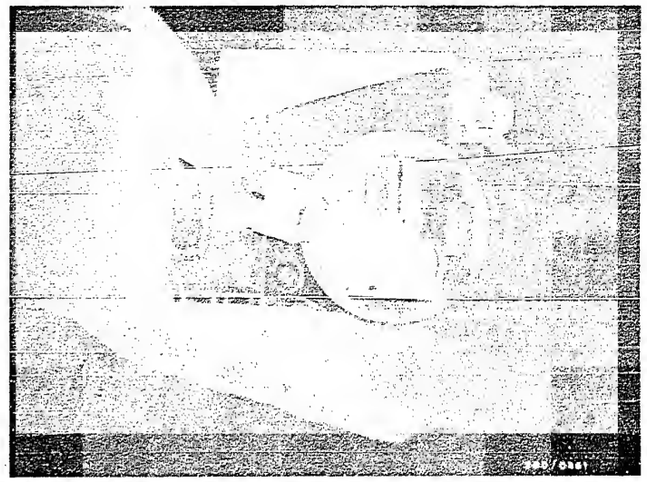
Testing:

* Unscrew air-flow sensor from air-flow filter housing. Open sensor flap by hand. It must be possible to open the sensor flap with uniform ease from its fully closed position to its fully open position. When released, it must close completely by itself. Sensor flap must not catch when opening. Watch for signs of rubbing or abrasion. Clean air-flow sensor if the inside is very dirty and rub out with a lint-free cloth. If there are signs of rubbing, replace air-flow sensor.

* Sensor flap must return to rest position. If not, the stopper or the sensor flap is bent. Replace air-flow sensor.

* Connect ohmmeter to term. 8 and term. 9 of air-flow sensor.
  Test specification: 160... 300 Ω
  Connect ohmmeter to term. 7 and term. 5 of air-flow sensor; deflect sensor flap.
  Test specification: 60...1000 Ω

C A U T I O N !
After testing is completed, the air-flow sensor must be screwed back onto the air-filter housing.



Opening the air-flow sensor flap

Continued on next picture page

Rough idle, incorrect idle speed (continued 6)

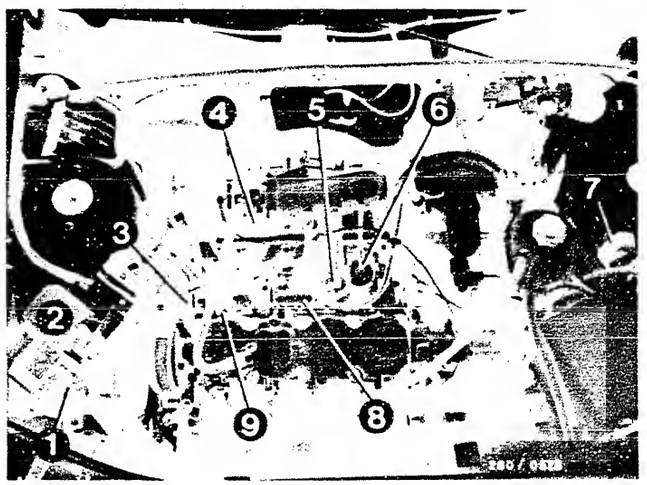
Are all hose lines correctly connected, not kinked or damaged?
Visual examination.

* Air-intake system checked for leaks with 0.3 bar gauge pressure?

N>

* Check whether hoses of air-intake system and fuel-line system are correctly connected, not kinked or damaged. If necessary, replace hoses.
Eliminate leaks by means of new seals or by retightening the connecting screws.

* Leak test:
Seal off exhaust tail pipe. Unscrew air-flow sensor from air-filter housing and seal off air-flow sensor duct.
Disconnect hose after auxiliary-air device and, using a compressed-air gun, blow air (0.3 bar gauge pressure) into the intake manifold.
Seal off connection port on auxiliary-air device.
Open throttle valve fully while doing this.
Brush or spray all joints with soapy water.
Leaks may also occur at the following points on the engine:
Oil dipstick not securely inserted, defective lid seal on oil filler neck etc.
Bubbling or foaming indicates a leak.



1 = Air filter
2 = Air-flow sensor
3 = Temperature sensor II
4 = Throttle-valve switch
5 = Solenoid-op. inj. valves
6 = Pressure regulator
7 = Control relay
8 = Auxiliary-air device
9 = Central ground

Continued on next picture page

Rough idle, incorrect idle speed (continued 7)

Idle speed correctly adjusted? N>

Y

Trouble-shooting program for customer complaint

"rough idle, incorrect idle speed"

completed.

If the fault has not been found or if further information is required on how to rectify the fault, continue with the trouble-shooting chart of your choice.

Detailed trouble-shooting chart coordinates B03/B04..
Direct trouble-shooting chart coordinates B05/B06..

* Lambda closed-loop control O.K.? N>

F15

* Adjusting the idle speed
Adjust the idle speed with the engine at normal operating temperature at the adjusting screw on the throttle-valve assembly.

* Idle speed

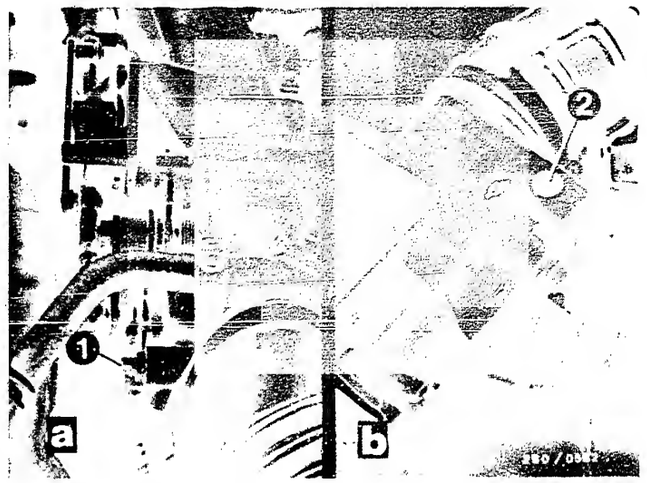
4-speed transmission:
850...900 min $^{-1}$

5-speed transmission:
900...950 min $^{-1}$

Automatic transmission:
800...850 min $^{-1}$

Check lambda closed-loop control (Coordinates G01...G13)

F16



1 = Idle-speed adjusting screw
2 = CO-adjusting screw

LAMBDA CLOSED-LOOP CONTROL

Checking and adjusting the CO concentration in the exhaust gas by changing the integ. vol. in veh. with lambda closed-loop contr.

Preparation for testing:

* Engine must be at normal operating temperature.
* Before testing, the engine must be operated for approx. 30 sec. at a speed of 3000 min^{-1} .
  The lambda sensor must be properly warmed up.
* Connect lambda closed-loop tester KDJE-P 600 with test clip (4) to measuring lead, test pin 22 (behind right-hand spring-strut crown) (if necessary, make adapter).
* Set lambda closed-loop tester to 12 V measuring range.
* Connect lambda closed-loop tester to positive (red clip) and negative (black clip) of battery. Green LED must light up!

The following conditions must have been met for checking the lambda closed-loop control:

* Jetronic universal-adapter test program performed.
* Fuel-pressure test performed.
* Engine at normal operating temperature.
* Lead from active-charcoal filter (if applicable) pinched off.
* Engine running.
* Lambda-sensor heating O.K.? Internal resistance (PTC) 1.0...10.0 Ω . Power supply approx. 12 V elec.-system vol.

Idle speed:
The idle speed must have been correctly adjusted.
Test specifications:

4-speed transmission	850...900 min^{-1}
5-speed transmission	900...950 min^{-1}
Automatic transmission	850...850 min^{-1}

CO adjustment (integrator voltage):

The CO concentration in the exhaust gas is adjusted indirectly via the integrator voltage of the lambda closed-loop control. For adjusting at the bypass screw on the air-flow sensor, the anti-tamper device must be drilled out (use suitable commercially available tools). After testing, it is e s s e n t i a l that a new lead seal be fitted (Part No. 1 283 123 004). The adjustment must be made in small steps (hexagon-socket-head cap screw AF 5) and the voltage reading must be checked after each step.

V

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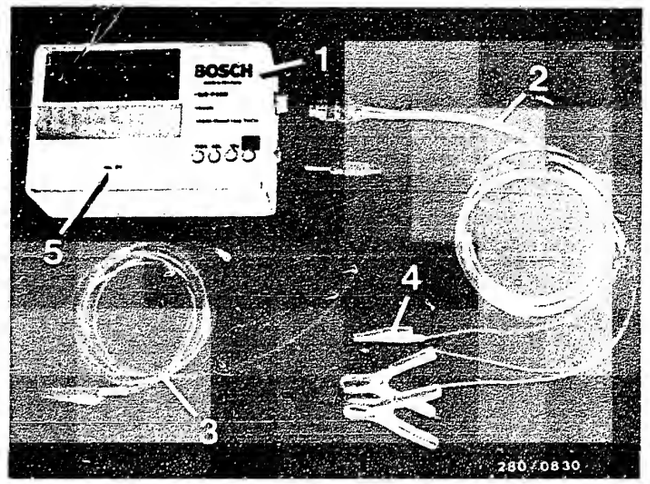
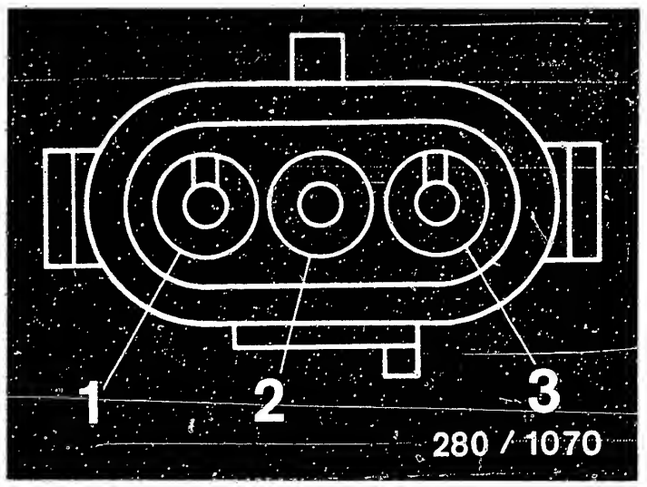


1 = Lambda closed-loop tester KDJE-P 600
2 = Connecting lead KDJE-P 600/51
3 = Lead KDJE-P 600/1
4 = Test clip to measuring lead, test pin 22.
5 = Power-supply indicator

1 = Lambda-sensor signal
2 = Heating, positive
3 = Heating, ground



Lambda closed-loop control (continued 1)

Adjustment of idle integrator voltage

Watch reading on lambda closed-loop tester (idle)

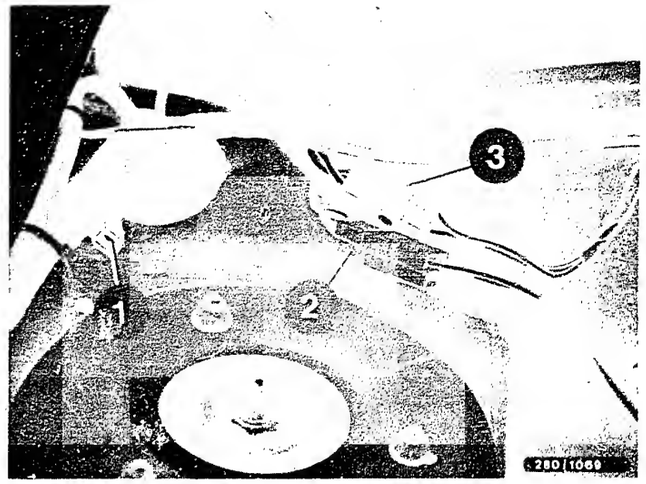
Reading m u s t fluctuate between two values (closed-loop control).

Operation O.K.?

N>

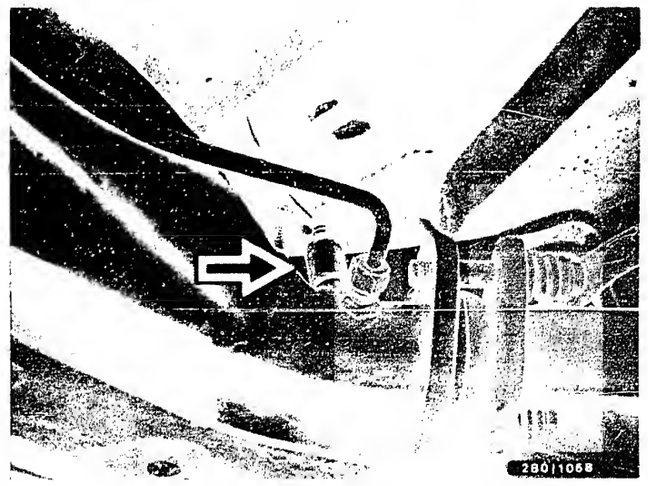
Sensor correctly preheated? Let engine run at idle.
Voltage reading now fluctuates.

* If not, ignition "OFF". Sensor lead not correctly connected at plug-in connection; contact resistances? Check and, if necessary, repair.
  Does idle voltage reading now fluctuate? If not, ignition "OFF", loosen plug-in connection.
  Check the following leads for continuity.
* From control-unit plug term. 20 to electronics ground terminal.
  Set value infinity Ω .
* Connect lead from control unit term. 20 at plug-in connection to ground.
  Set value approx. 0 Ω .
  If not, replace lead.
  Caution: Sensor lead must be shielded. Lambda sensor must n o t be checked directly with a multimeter. Measuring current may destroy lambda sensor. Plug together plug-in connection.
  Let engine run at idle. Voltage reading now fluctuating? If not, ignition "OFF".



1 = Test pin 22
Integrator voltage
2 = 3-pin plug-in connection to lambda sensor
3 = 3-pin plug-in connection, power supply

Arrow = Lambda sensor



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Lambda closed-loop control (continued 2)

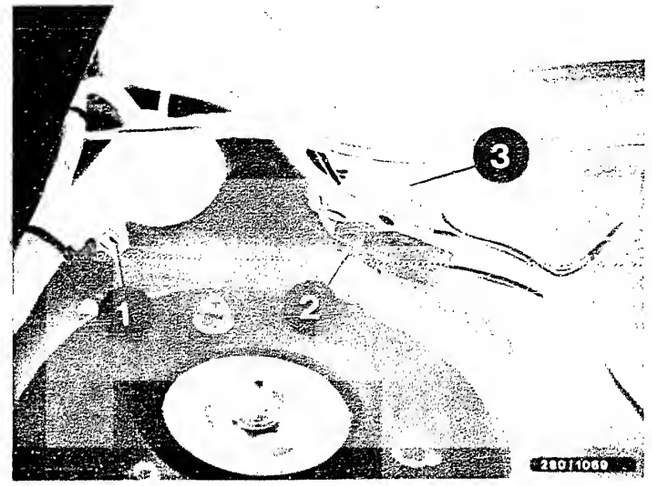
Check the following leads for continuity:

* From control-unit plug term. 22 to measuring connection, test pin 22.
  Set value approx. 0 Ω .
  If not, replace lead.
  Let engine run at idle.
  Voltage reading now fluctuating?
  If not,

* lambda sensor defective. When mounting a new sensor, use grease Vs 140 16 Ft.

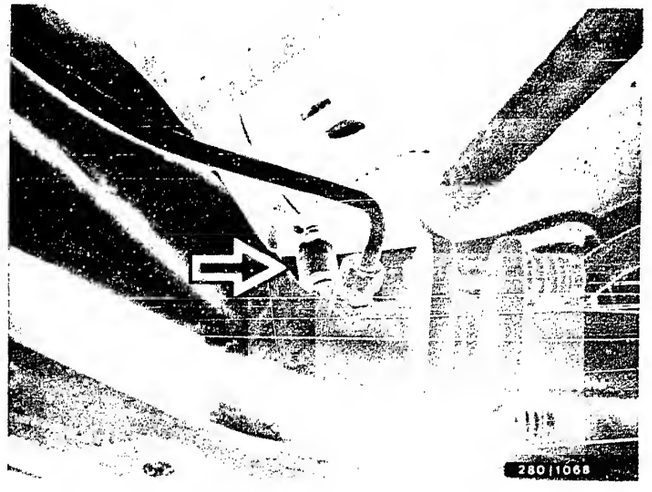
* LU control unit defective.

Continued on next picture page



1 = Test pin 22
Integrator voltage
2 = 3-pin plug-in connection to lambda sensor
3 = 3-pin plug-in connection, power supply

Arrow = Lambda sensor



Lambda closed-loop control (continued 3)

Form average value of the two extreme voltage values (closed-loop control U_R).
Average value noted down?

Y

Loosen sensor connector.
Make voltage reading and note down.
(Open-loop control U_s).
Are both voltage values of the same magnitude
($U_s = U_R$)?

N>

Air-intake system with hose to pressure regulator leak-tight?
If necessary, rectify fault.
Exhaust system leak-tight?
If necessary, repair.

No fault detectable?

Adjustment of integrator voltage and, with it, also the CO concentration in the exhaust by the adjusting screw on the air-flow sensor (with sensor connected).

Note down average voltage value (closed-loop control U_R).
Loosen sensor connector (disconnect sensor).

Read off voltage (open-loop control U_s).

Both readings must be identical.

If necessary, repeat the adjustment until both voltage readings are identical.

Adjustment of integrator voltage only in closed-loop control mode (sensor connected).

If not adjustable and the previous tests have been performed properly -> replace air-flow sensor.
If integrator voltage still not adjustable, replace LU control unit.

Y

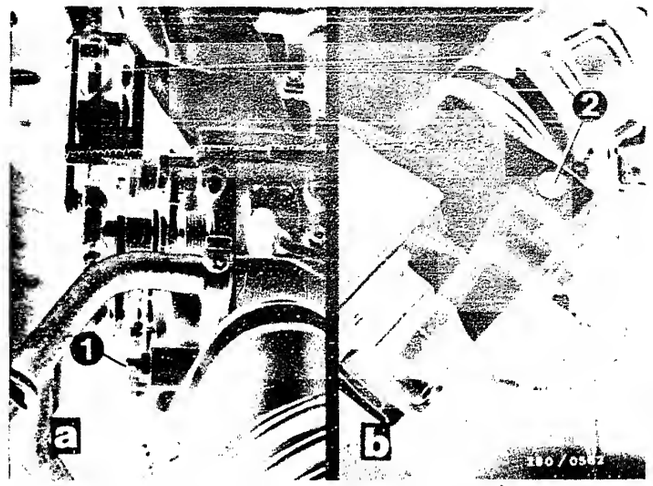
Adjustment of idle integrator voltage completed.

Y

Sensor lead m u s t be reconnected.

Y

Continued on next picture page



1 = Idle-speed adjusting screw
2 = CO-adjusting screw

Lambda closed-loop control (continued 4)

Checking of rich value

Let engine idle. Engine at operating temperature.

Loosen sensor connector and touch sensor lead (coming from control unit) against ground.

Does voltage reading rise to 10...12 V (rich)?

N>

Check ground connection for sensor lead.

Eliminate any contact resistances.

If fault still present, replace LU control unit.

Y

Checking of lean value

Let engine idle. Engine at normal operating temperature.

Connect sensor lead (coming from control unit) to the 2 V output of the lambda closed-loop tester KDJE-P 600. (Lead KDJE-P 600/1).

Does the voltage reading drop to approx. 0.5 V (lean)?

N>

Check 2 V voltage at lambda closed-loop tester.

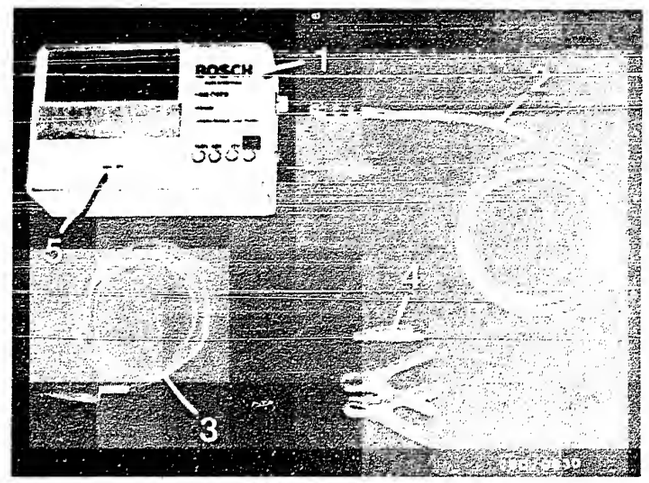
If voltage present, replace LU control unit.

If not voltage, lambda closed-loop tester defective.

Y

Sensor lead m u s t be reconnected.

Continued on next picture page



1 = Lambda closed-loop tester KDJE-P 600
2 = Connecting lead KDJE-P 600/51
3 = Lead KDJE-P 600/1
4 = Test clip to measuring lead, test pin 22.
5 = Power-supply indicator

Lambda closed-loop control (continued 5)

Checking of overrun-cutoff function.

Operate engine between 3000 min $^{-1}$ and 4000 min $^{-1}$ (no load, air conditioner must be off). Read off voltage on lambda closed-loop tester.

Closed-loop mode:
release accelerator suddenly.
Make voltage reading.

Open-loop mode:
at reinstatement speed approx. 1200 min $^{-1}$.

Closed-loop mode:
sequence of functions O.K.?

N>

Sensor not properly hot?

Let engine run for approx. 3 sec at 3000 min $^{-1}$ –

Repeat test.

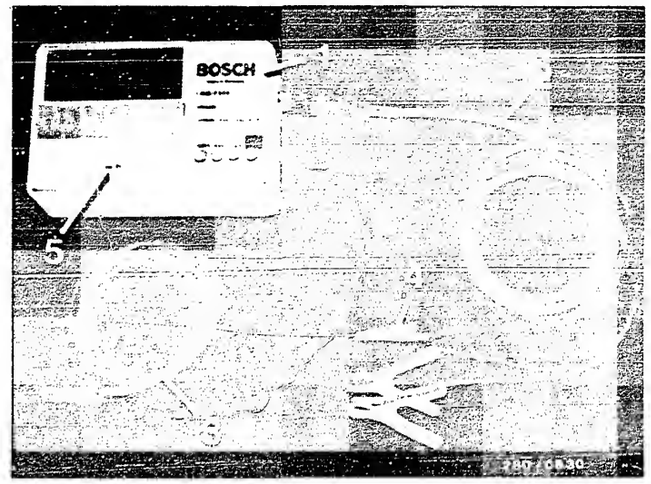
Sequence of functions O.K.?

If not, plug-in connection not correctly connected.

Rectify fault.

Sequence of functions O.K.?

If not, replace LU control unit.



1 = Lambda closed-loop tester KDJE-P 600
2 = Connecting lead KDJE-P 600/51
3 = Lead KDJE-P 600/1
4 = Test clip to measuring lead, test pin 22.
5 = Power-supply indicator

Continued on next picture page

G11 —— <==> G12 —— <==

Remove lambda closed-loop tester KDJE-P 600 with its connecting leads from the engine compartment.
Re-establish all cable connections.
Restore to original condition.
After adjusting, fit new anti-tamper device (seal) on air-flow sensor (part no. 1 283 123 004).

Testing of lambda closed-loop control with lambda closed-loop tester KDJE-P 600 is now completed.

Further possible faults:

* Customer complaint incorrectly diagnosed (see coordinates B03...B08). If the fault has not been detected by "direct trouble-shooting", see "detailed trouble-shooting" (Coordinate B03/B04).

* Engine not mechanically O.K. (compression, valve adjustment, valve timing, worn camshaft).

POOR THROTTLE TAKE-UP

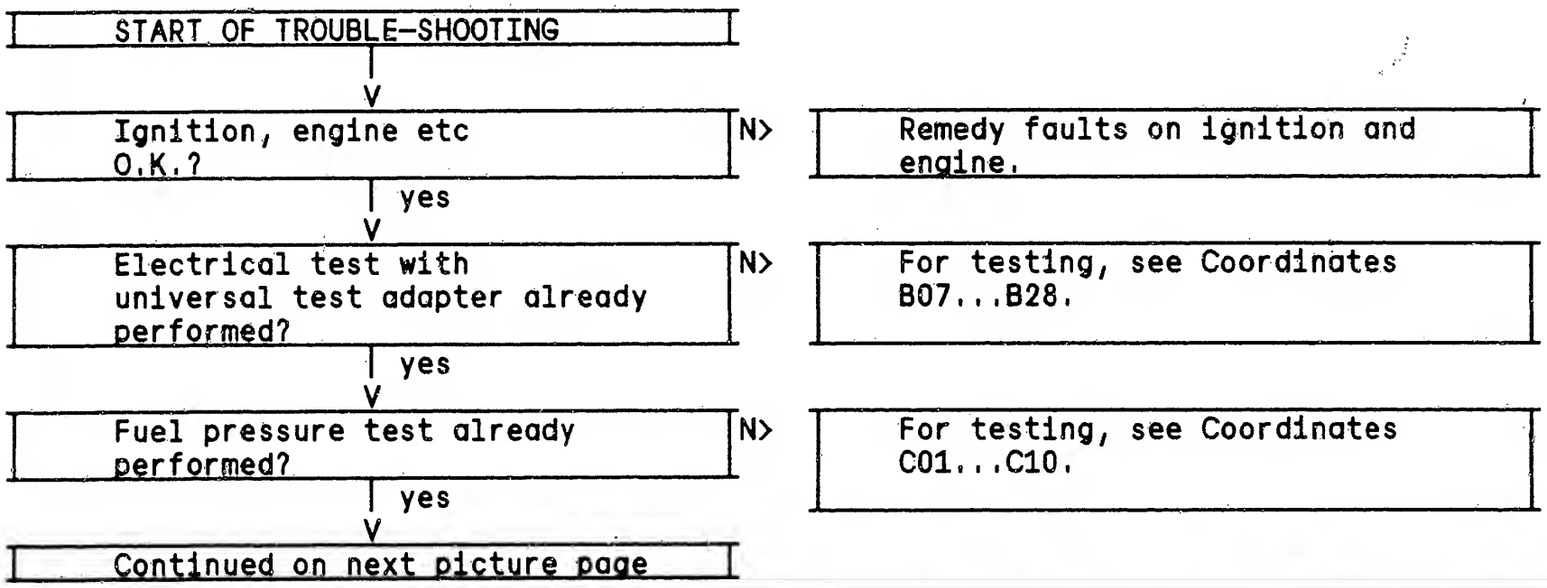
Trouble-shooting program according to customer complaints

Procedure

The test is divided into 3 rows of boxes:

* The left-hand row contains the questions for the tests.
* The center row describes the testing and adjusting operations on the components.
* The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be conclusively answered with "yes" without testing, proceed to the next question down.
If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there.
After testing, continue trouble-shooting at the point at which you branched off.



H01 ==> H02 <==>

Poor throttle take-up (continued 1)

Throttle valve closed?
Engine coughing on overrun?

* Does throttle lever come up against stop screw? N>
* Throttle cable free of tension?
* Throttle cable not kinked?

* Testing:
Check whether the throttle valve can be closed still further and whether the engine speed thereby drops.

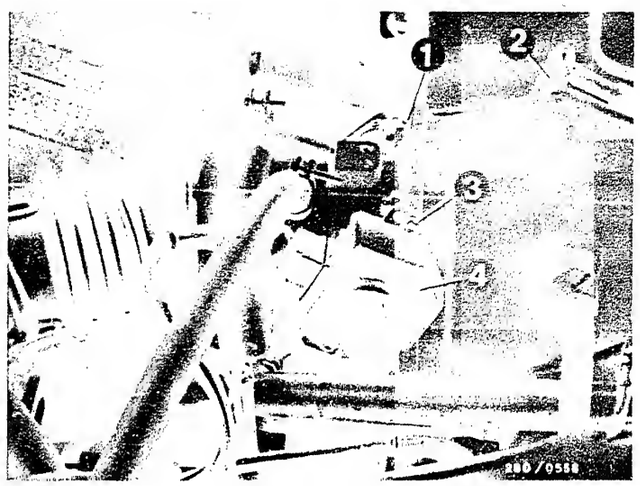
* Adjusting the throttle valve:
The throttle valve must come up against the stop screw with the throttle lever just before it sticks. Lock stop screw with lock nut.

* If throttle cable kinked – replace.

Throttle-valve switch correctly adjusted? N>
* Idle contact closing?
* Microswitch clicking audibly?

* Adjustment
Loosen fastening screws slightly. Connect ohmmeter between term. 2 and term. 9/4. Turn throttle-valve switch in a counterclockwise direction until the idle contact closes (microswitch clicks audibly).
Reading: 0 Ω .

* Checking the adjustment:
Pull slightly on throttle cable. The idle contact opens (microswitch clicks audibly).
Reading infinity Ω .



1 = Throttle-valve stop screw
2 = Throttle lever
3 = Fastening screws
4 = Throttle-valve switch

Continued on next picture page

Poor throttle take-up (continued 2)

Auxiliary-air device mechanically O.K.?
Free cross section:
* cold – open?
* warm – closed?
* Drop in engine speed when hose pinched off

N>

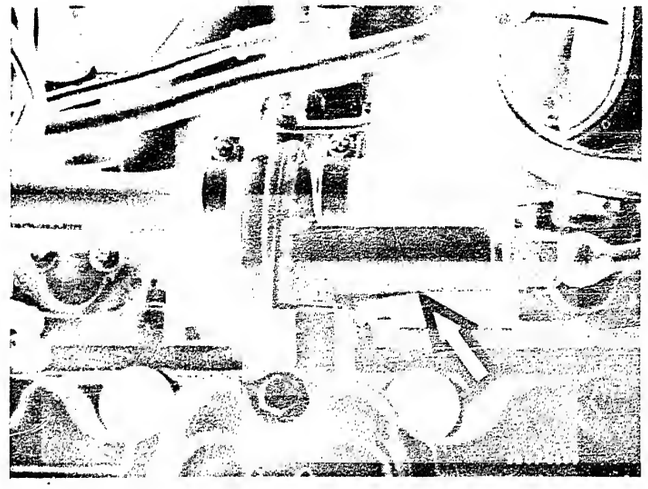
<u>Checking the auxiliary-air device</u>

<u>* Visual examination</u>

Disconnect hoses and look down (possibly using a small mirror). When cold, the cross section must be particlly open; when the engine is warm, it must be closed. If not, replace auxiliary-air device.

<u>* Functional test:</u>

With the engine cold, pinch off hose to auxiliary-air device. Engine speed <u>must</u> drop. With engine warm, pinch off hose to auxiliary-air device. There must be <u>no noticeable</u> drop in engine speed. If not, replace auxiliary-air device (paying attention to direction of flow).



Arrow = Auxiliary-air device

Electrical operation of auxiliary-air device (power supply, ground lead, resistance)
O.K.?

N>

Start engine.
* Voltage at plug <u>at least 12 V.</u>
  If not, check the following leads for continuity (set value approx. 0 Ω):
* From term. 26 to central ground
* From term. 9/2 to control relay term. 87.
* Resistance of auxiliary-air device 30...65 Ω (plug disconnected).
  If resistance not within tolerance, replace auxiliary-air device.

Continued on next picture page

Poor throttle take-up (continued 3)

Air-flow sensor mechanically and electrically O.K.?

* Sensor flap moving freely?
* Does sensor flap return to rest position?
* Resistances within tolerance?

N>

Between term. 8 and term. 9:
160... 300 Ω

Between term. 7 and term. 5
(Deflect sensor flap fully):
60...1000 Ω

V

Continued on next picture page

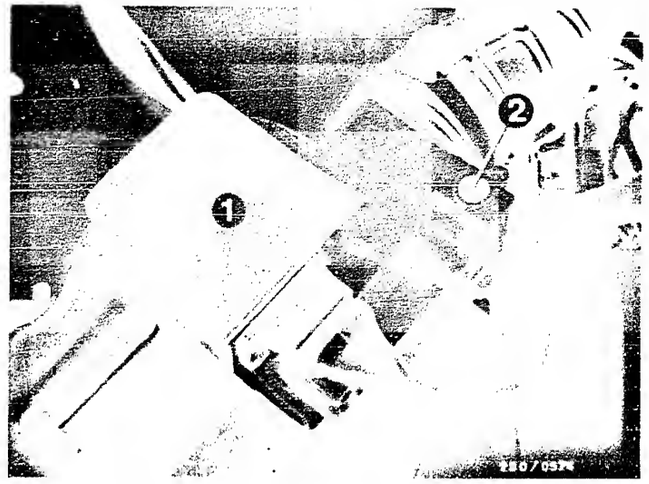
Testing:

* Unscrew air-flow sensor from air-flow filter housing. Open sensor flap by hand. It must be possible to open the sensor flap with uniform ease from its fully closed position to its fully open position. When released, it must close completely by itself. Sensor flap must not catch when opening. Watch for signs of rubbing or abrasion. Clean air-flow sensor if the inside is very dirty and rub out with a lint-free cloth. If there are signs of rubbing, replace air-flow sensor.

* Sensor flap must return to rest position. If not, the stopper or the sensor flap is bent. Replace air-flow sensor.

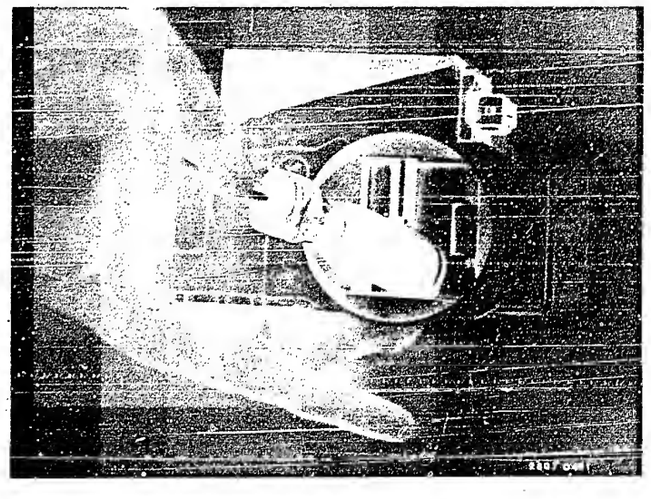
* Connect ohmmeter to term. 8 and term. 9 of air-flow sensor.
  Test specification: 160... 300 Ω
  Connect ohmmeter to term. 7 and term. 5 of air-flow sensor; deflect sensor flap.
  Test specification: 60...1000 Ω

C A U T I O N !
After testing is completed, the air-flow sensor must be screwed back onto the air-filter housing.



1 = Air-flow sensor
2 = CO adjusting screw

Opening the air-flow sensor flap



Poor throttle take-up (continued 4)

V

Air-flow sensor potentiometer O.K.?

N>

* Potentiometer wiper track O.K.?

* Stroke signal correct?

Y

V

Continued on next picture page

Test of potentiometer:
(Noise test)

* Unscrew air-flow sensor from air-filter housing and loosen hose clamp. Leave plug on. Set motortester to special input and, using the special cable, connect to air-flow sensor term. 7 (red clip) and term. 5 (black clip).

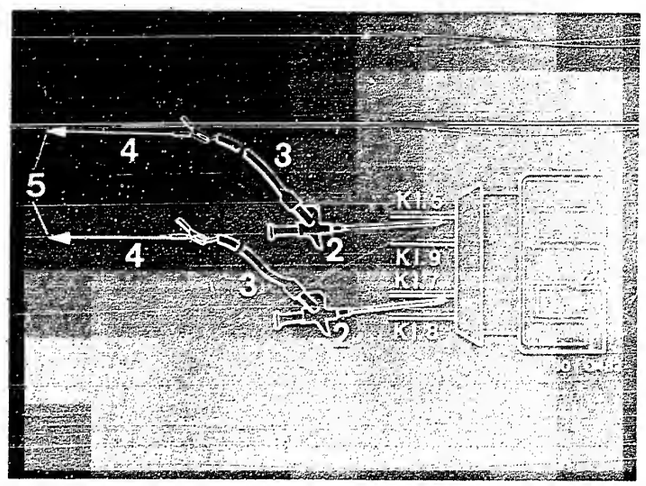
* Making the adapter lead:
two approx. 1 m long leads approx. 1.0 mm ^{2} cross section and 10 A fuse. Secure at one end. At the other end, strip off approx. 2 cm of insulation and connect to the terminals of the special-input connecting lead.

C A U T I O N !
Insulate bare connecting points of adapter lead (danger of short circuit). Carefully measure into the plug of the air-flow sensor. Do not bend any connecting springs. Set control lever for image adjustment on motortester as far as it will go to the left (calibrated setting).

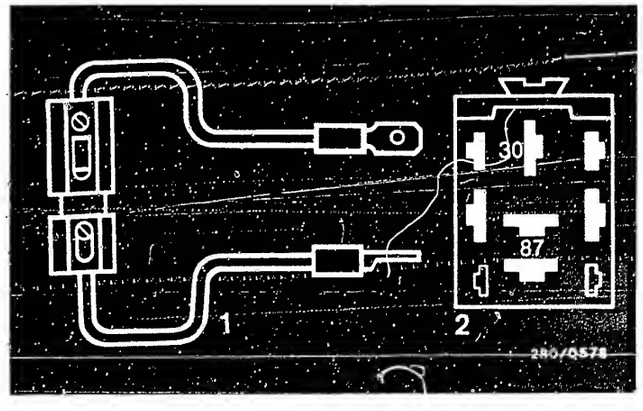
* Disconnect control relay. Connect jumper in connection base between term. 87 and term. 30. (Power supply from control unit).

V

Continued on next picture page



1 = Air-flow sensor plug
2 = Test prod
3 = Adapter lead (User-fabricated)
4 = Special input connecting lead
5 = Motortester special input



1 = Jumper with fuse holder and 10 A fuse (user-fabricated)
2 = Top view of connection base

Poor throttle take-up (continued 5)

* Deflect air-flow sensor flap suddenly several times.

If air-flow sensor O.K., a continuous signal must be visible on the oscilloscope.

If air-flow sensor defective, a noise signal appears, similar to the one shown opposite.
Replace air-flow sensor.

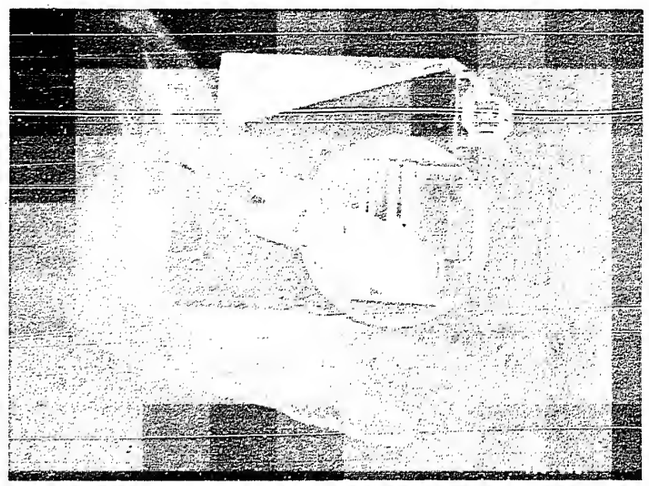
Disconnect adapter lead after testing and push on rubber sleeve properly.

Mount air-flow sensor.

Connect all hoses and tighten (no leaks).

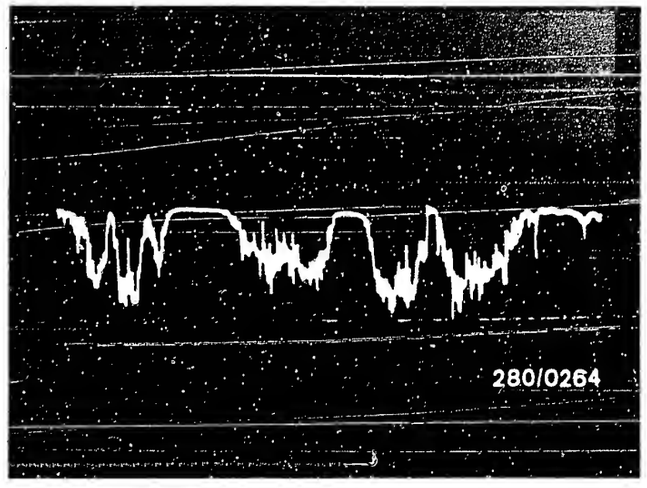
C A U T I O N !

After testing, remove jumper and connect control relay.



Opening the air-flow sensor flap

Noise signal if air-flow sensor defective



Continued on next picture page

Poor throttle take-up (continued 6)

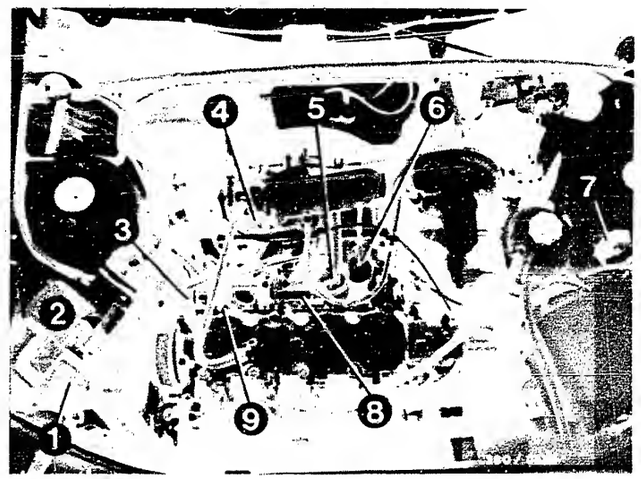
Are all hose lines correctly connected, not kinked or damaged?
Visual examination.

* Air-intake system checked for leaks with 0.3 bar gauge pressure?

N>

* Check whether hoses of air-intake system and fuel-line system are correctly connected, not kinked or damaged. If necessary, replace hoses.
Eliminate leaks by means of new seals or by retightening the connecting screws.

* Leak test:
Seal off exhaust tail pipe. Unscrew air-flow sensor from air-filter housing and seal off air-flow sensor duct.
Disconnect hose after auxiliary-air device and, using a compressed-air gun, blow air (0.3 bar gauge pressure) into the intake manifold.
Seal off connection port on auxiliary-air device.
Open throttle valve fully while doing this.
Brush or spray all joints with soapy water.
Leaks may also occur at the following points on the engine:
Oil dipstick not securely inserted, defective lid seal on oil filler neck etc.
Bubbling or foaming indicates a leak.



1 = Air filter
2 = Air-flow sensor
3 = Temperature sensor II
4 = Throttle-valve switch
5 = Solenoid-op. inj. valves
6 = Pressure regulator
7 = Control relay
8 = Auxiliary-air device
9 = Central ground

Continued on next picture page

Poor throttle take-up (continued 7)

V

Idle speed and CO correctly adjusted? N>

Y

V

Idle speed not adjustable.

Y

V

Trouble-shooting program for customer complaint

"poor throttle take-up"

completed.

If the fault has not been found or if further information is required on how to rectify the fault, continue with the trouble-shooting chart of your choice.

Detailed trouble-shooting chart coordinates B03/B04.
Direct trouble-shooting chart coordinates B05/B06.

Idle-speed and CO adjustment

Exhaust-gas adjustment with lambda closed-loop tester with engine at normal operating temperature and at idle speed.

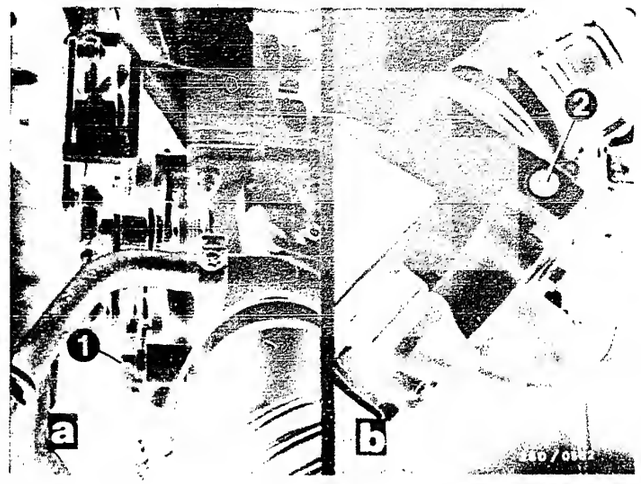
* Idle speed
  4-speed transmission:
  850...900 min $^{-1}$
  5-speed transmission:
  900...950 min $^{-1}$
  Automatic transmission:
  800...850 min $^{-1}$

* CO adjustment via lambda integrator voltage
  Lambda closed-loop control:

  Closed-loop mode (sensor connected):
  Voltage reading fluctuates between 2 values.

  Open-loop mode (sensor lead taken apart):
  Voltage reading must be identical with the average value of the fluctuating reading.

If not, adjust at bypass screw (CO-adjusting screw) in air-flow sensor (hexagon-socket-head cap screw AF = 5 mm).
Check idle speed and voltage reading once again. If necessary, make corrections in several steps.
After adjusting, use new seal (1 283 123 004).



1 = Idle-speed adjusting screw
2 = CO adjusting scew

ENGINE MISSING UNDER ALL OPERATING CONDITIONS

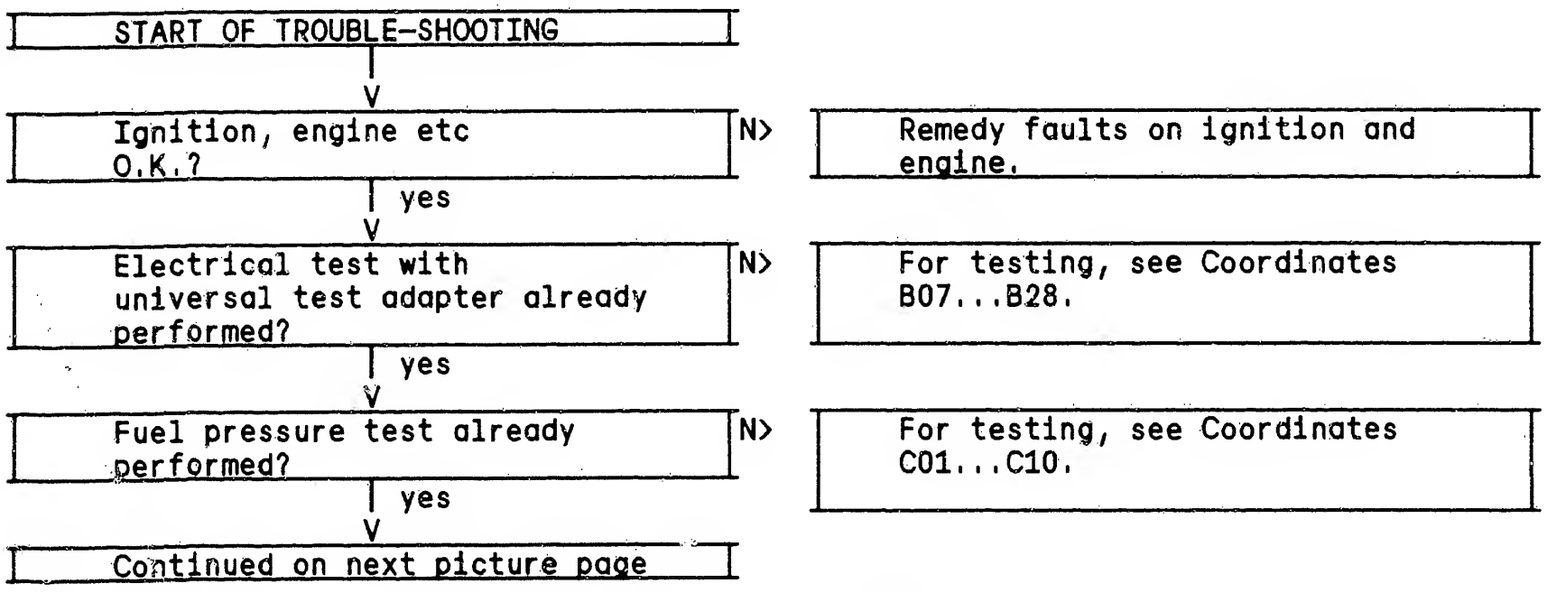
Trouble-shooting program according to customer complaints

Procedure

The test is divided into 3 rows of boxes:

* The left-hand row contains the questions for the tests.
* The center row describes the testing and adjusting operations on the components.
* The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be conclusively answered with "yes" without testing, proceed to the next question down.
If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there.
After testing, continue trouble-shooting at the point at which you branched off.



J01 ==> J02 <==>

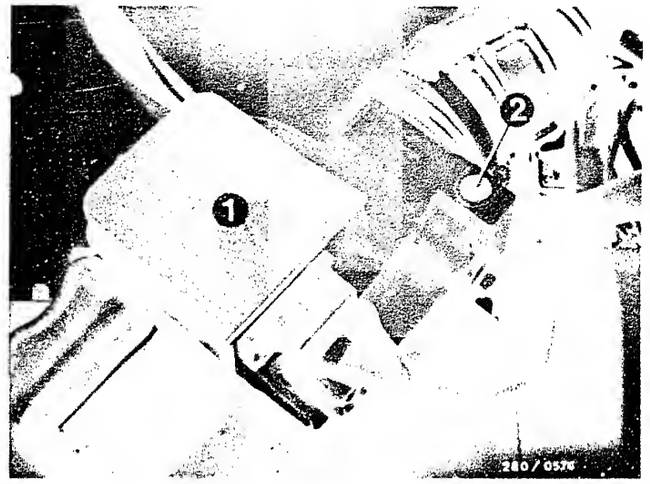
Engine missing under all operating conditions (continued 1)

Alternator with regulator O.K.?

* Engine not missing due to voltage spikes?

N> * With engine off, disconnect plug from alternator. Start engine. If missing stops, check alternator and regulator. Voltage spikes are visible on the ignition oscilloscope.

Y



1 = Air-flow sensor
2 = CO adjustment screw

Continued on next picture page

Air-flow sensor mechanically and electrically O.K.?

* Sensor flap moving freely?
* Does sensor flap return to rest position?
* Resistances within tolerance?

N>

Between term. 8 and term. 9:
160... 300 Ω

Between term. 7 and term. 5
(Deflect sensor flap fully):
60...1000 Ω

Y

Testing:

* Unscrew air-flow sensor from air-flow filter housing. Open sensor flap by hand. It must be possible to open the sensor flap with uniform ease from its fully closed position to its fully open position. When released, it must close completely by itself. Sensor flap must not catch when opening. Watch for signs of rubbing or abrasion. Clean air-flow sensor if the inside is very dirty and rub out with a lint-free cloth. If there are signs of rubbing, replace air-flow sensor.

* Sensor flap must return to rest position. If not, the stopper or the sensor flap is bent. Replace air-flow sensor.

* Connect ohmmeter to term. 8 and term. 9 of air-flow sensor.
  Test specification: 160... 300 Ω
  Connect ohmmeter to term. 7 and term. 5 of air-flow sensor; deflect sensor flap.
  Test specification: 60...1000 Ω

C A U T I O N !
After testing is completed, the air-flow sensor must be screwed back onto the air-filter housing.

Opening the air-flow sensor flap

Continued on next picture page

Engine missing under all operating conditions (continued 3)

V

Air-flow sensor potentiometer O.K.?

* Potentiometer wiper track O.K.?

* Stroke signal correct?

N>

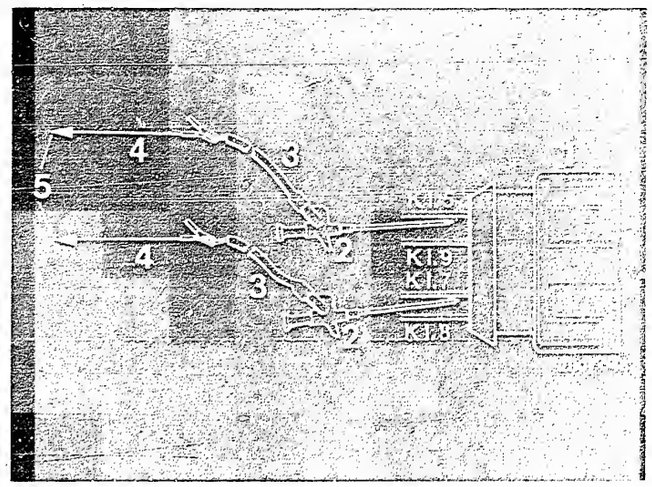
Test of potentiometer:
(Noise test)

* Unscrew air-flow sensor from air-filter housing and loosen hose clamp. Leave plug on. Set motortester to special input and, using the special cable, connect to air-flow sensor term. 7 (red clip) and term. 5 (black clip).

* Making the adapter lead:
two approx. 1 m long leads approx. 1.0 mm ^{2} cross section and 10 A fuse. Secure at one end. At the other end, strip off approx. 2 cm of insulation and connect to the terminals of the special-input connecting lead.

C A U T I O N !
Insulate bare connecting points of adapter lead (danger of short circuit). Carefully measure into the plug of the air-flow sensor. Do not bend any connecting springs. Set control lever for image adjustment on motortester as far as it will go to the left (calibrated setting).

* Disconnect control relay. Connect jumper in connection base between term. 87 and term. 30. (Power supply from control unit).



1 = Air-flow sensor plug
2 = Test prod
3 = Adapter lead (User-fabricated)
4 = Special input connecting lead
5 = Motortester special input

1 = Jumper with fuse holder and 10 A fuse (user-fabricated)
2 = Top view of connection base

V

Continued on next picture page

V

Continued on next picture page

J07 — <⟹>

J08 — <⟹>

Engine missing under all operating conditions (continued 4)

V

* Deflect air-flow sensor flap suddenly several times.

If air-flow sensor O.K., a continuous signal must be visible on the oscilloscope.

If air-flow sensor defective, a noise signal appears, similar to the one shown opposite.
Replace air-flow sensor.

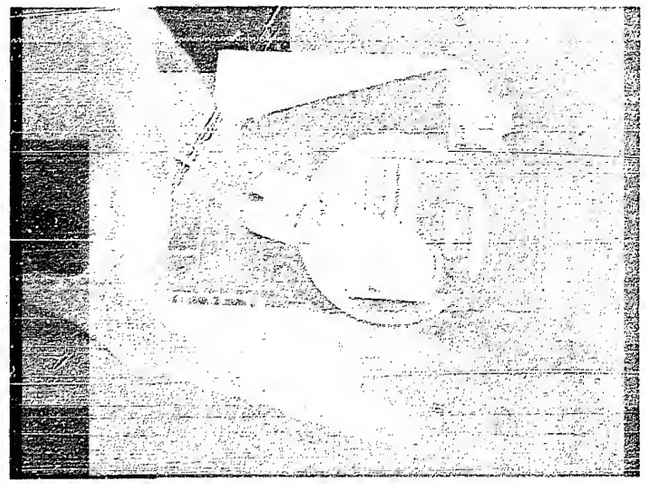
Disconnect adapter lead after testing and push on rubber sleeve properly.

Mount air-flow sensor.

Connect all hoses and tighten (no leaks).

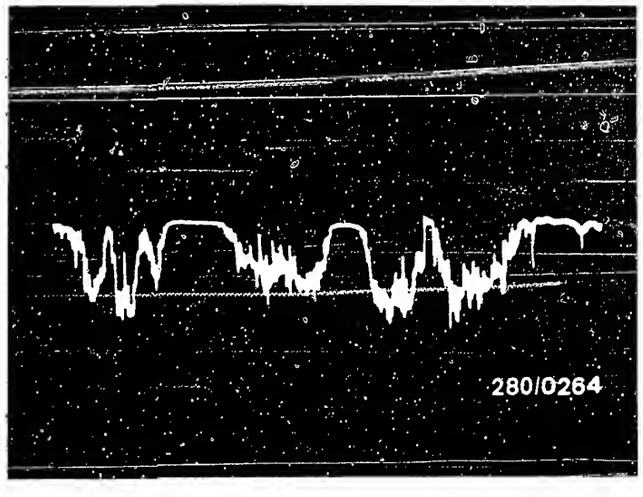
C A U T I O N !

After testing, remove jumper and connect control relay.



Opening the air-flow sensor flap

Noise signal if air-flow sensor defective



V

Continued on next picture page

Engine missing under all operating conditions (continued 5)

Delivery of electric fuel pump O.K.?
Test specification: min. 700 cm ^{3} /30 s

N>

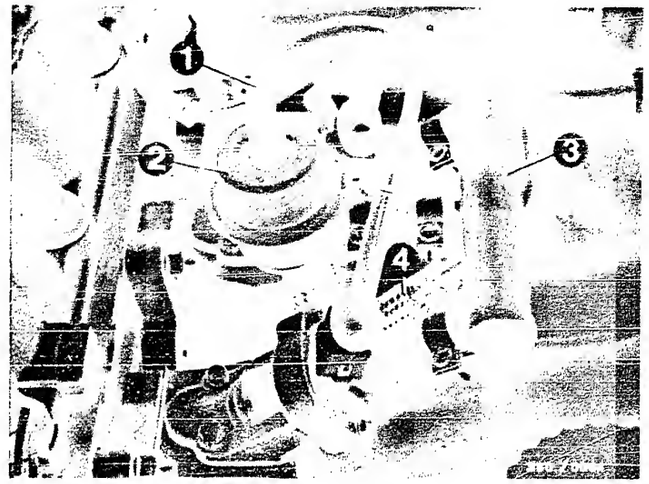
* Measuring the fuel delivery:
For testing, undo junction between fuel return hose (from pressure regulator) and fuel return line (to fuel tank). If necessary, extend hose and lead into a 5l vessel with graduated scale. Disconnect control relay. Connect jumper into connection base between term. 87b and term. 30. Electric fuel pump must operate.

Test specification:
min. 700 cm ^{3} /30s

Caution: After testing is completed, be sure to remove the jumper.

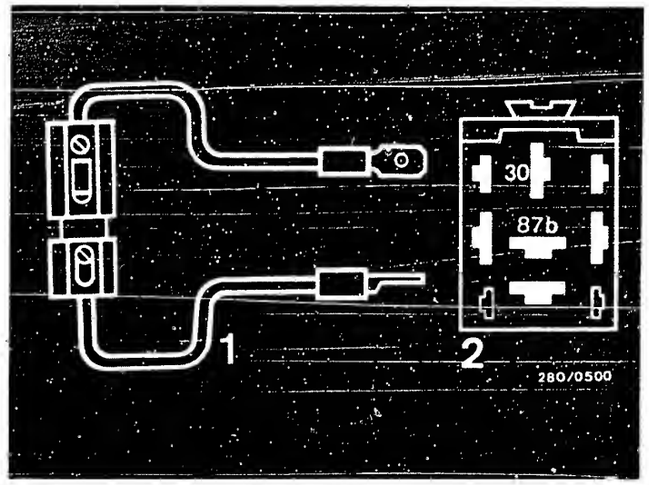
Remedy if test specification not obtained:
* Fuel filter clogged – replace.
* Voltage at the terminals of the electric fuel pump with engine running: min. 12 V. If not, clean contacts; possibly eliminate poor ground connection; replace leads.

* Fuel pressure regulator defective – replace.
* If delivery too low, replace electric fuel pump.



1 = Intake manifold connection
2 = Pressure regulator
3 = Fuel-distribution pipe (fuel delivery line)
4 = Fuel return line

1 = Jumper with fuse holder and 10 A fuse (user-fabricated)
2 = Top view of connection base



Continued on next picture page

Engine missing under all operating conditions (continued 6)

Control unit O.K.?
* Engine not missing?
* Plug-in connections on control-unit plug O.K.?

N>

Let engine run.

* Shake control unit lightly and move control-unit plug. Watch for engine missing.

* Repair plug-in connection at control-unit plug or replace defective control unit.

Engine coughing on overrun?
* Exhaust system leak-tight?

N>

* Check exhaust system for leaks.

Throttle valve closed?
Engine coughing on overrun?

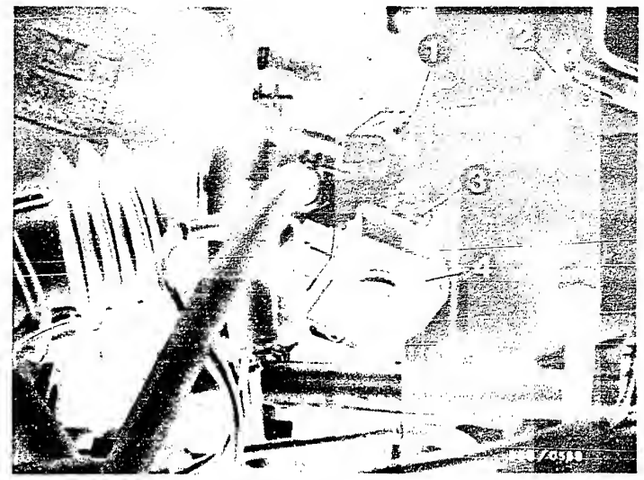
* Does throttle lever come up against stop screw?
* Throttle cable free of tension?
* Throttle cable not kinked?

N>

* Testing:
Check whether the throttle valve can be closed still further and whether the engine speed thereby drops.

* Adjusting the throttle valve:
The throttle valve must come up against the stop screw with the throttle lever just before it sticks. Lock stop screw with lock nut.

* If throttle cable kinked - replace.



1 = Throttle-valve stop screw
2 = Throttle lever
3 = Fastening screws
4 = Throttle-valve switch

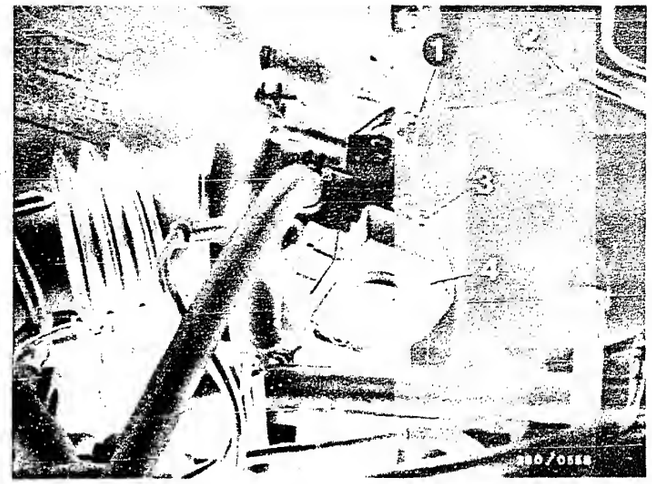
Continued on next picture page

Engine missing under all operating conditions (continued 7)

Throttle-valve switch correctly adjusted?
* Idle contact closing?
* Microswitch clicking audibly?

N>

* Adjustment
  Loosen fastening screws slightly. Connect ohmmeter between term. 2 and term. 9/4. Turn throttle-valve switch in a counterclockwise direction until the idle contact closes (microswitch clicks audibly).
  Reading: 0 Ω .
* Checking the adjustment:
  Pull slightly on throttle cable. The idle contact opens (microswitch clicks audibly).
  Reading infinity Ω .



1 = Throttle-valve stop screw
2 = Throttle lever
3 = Fastening screws
4 = Throttle-valve switch

Continued on next picture page

Engine missing under all operating conditions (continued 8)

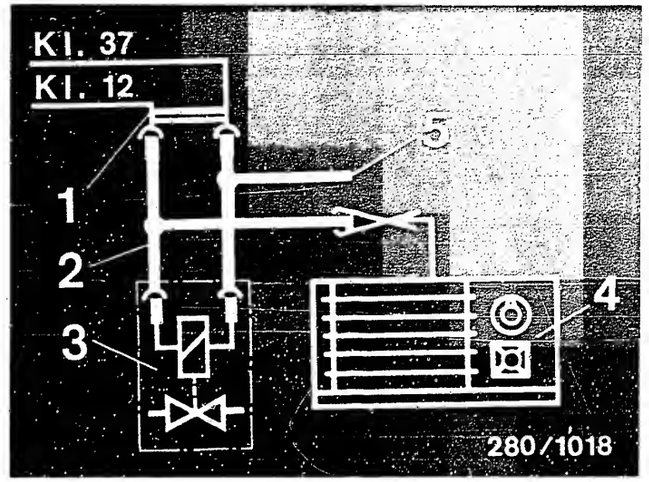
Engine coughing on overrun?
Overrun cutoff O.K.?

* Operation of control unit O.K.?

* Reinstatement speed O.K.?
  cold: 1700 min $^{-1}$
  warm: 1200 min $^{-1}$

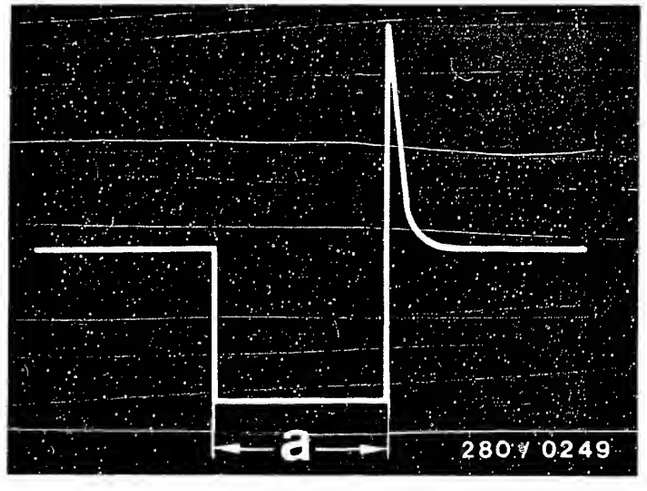
N>

* Checking the operation of the overrun cutoff:
Connect test lead as follows:
The two-pole plug connections of the test lead are connected between an injection valve and its connecting lead. Of the other two connection terminals of the test lead, only one terminal need be connected to the special input of the motortester. If correctly connected, the pattern shown opposite is visible on the oscilloscope. Watch oscilloscope.
* Slowly raise engine speed to 3,000 min $^{-1}$.
Injection pulses must be visible on the oscilloscope. Take foot off accelerator (idle position). No more injection pulses.
* Engine clearly below ambient temperature (+15° C...+30° C):
As of approx. 1700 min $^{-1}$ injection pulses must be visible again.
* Engine at operating temperature (approx. +80° C):
As of approx. 1200 min $^{-1}$ injection pulses must be visible again.
If incorrect, replace control unit.



1 = Valve-lead connector
2 = Test lead 1 684 463 093
3 = Sol.-op- injection valve
4 = Motortester
5 = Free terminal
(Do not bring into contact with ground)

a = Pulse length (dependent on engine load)



Continued on next picture page

Engine missing under all operating conditions (continued 9)

Injection valves checked for correct operation?

* Injection pulse without interference or missing? N>
* Leads correctly routed?
* No loose contacts in plug-in connections?

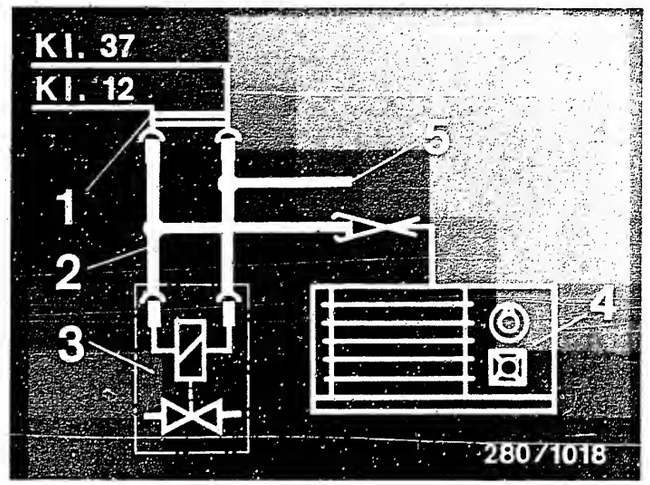
Y

Continued on next picture page

* Connect test lead as follows: Connect the two-pole plug connections of the test lead between an injection valve and its connecting lead. Of the other two terminals of the test lead, only <u>one</u> terminal need be connected to the special input of the motortester.

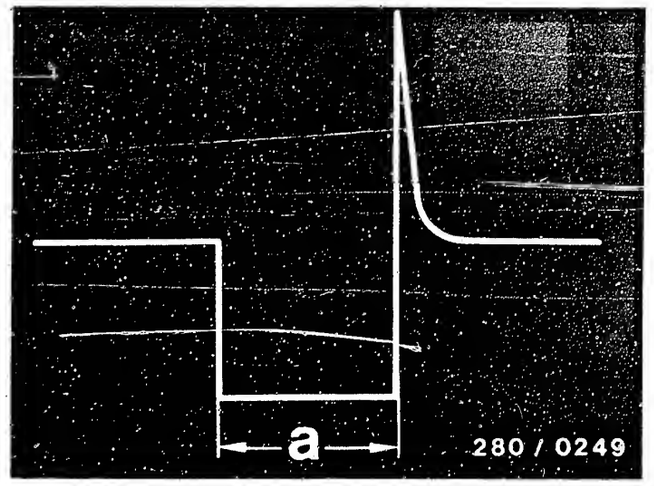
C A U T I O N !
The free terminal must not come into contact with the vehicle body.

* If correctly connected, the pattern shown opposite will be visible on the oscilloscope. With the aid of the test lead, it is possible to check the injection pulses at the injection valves with an ignition oscilloscope with the engine running. If the pattern shown opposite is not obtained or if there are deviations (interference, missing etc), the other injection valves should also be examined.
* In case of interference: check routing of leads.
* In case of missing: eliminate loose contacts in leads or in plug-in connections.



1 = Valve-lead connector
2 = Test lead 1 684 463 093
3 = Sol.-op- injection valve
4 = Motortester
5 = Free terminal (Do not bring into contact with ground)

a = Pulse length (dependent on engine load)



Engine missing under all operating conditions (continued 10)

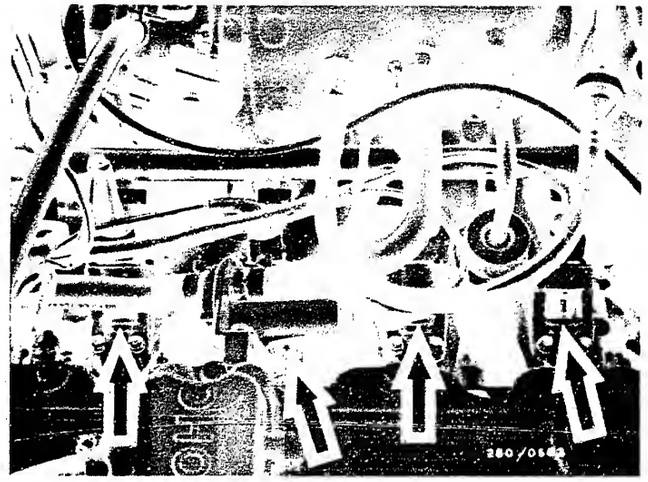
V

Injection valve mechanically O.K.?
* Does engine speed drop when injection-valve connectors are pulled off?

N>

* With the engine running, disconnect injection-valve connectors individually, one after the other, from the injection valves and re-connect. Engine speed must drop if injection valve O.K.

* If replacing, install only injection valves 0 280 150 205.



Arrows = Injection valves

Y

V

Continued on next picture page

J21 — <⟹>

J22 — <⟹>

Engine missing under all operating conditions (continued 11)

Idle speed and CO correctly adjusted? N>

Idle speed not adjustable.

Trouble-shooting program for customer complaint

"engine missing under all operating conditions"

completed.

If the fault has not been found or if further information is required on how to rectify the fault, continue with the trouble-shooting chart of your choice.

Detailed trouble-shooting chart coordinates B03/B04.
Direct trouble-shooting chart coordinates B05/B06.

Idle-speed and CO adjustment

Exhaust-gas adjustment with lambda closed-loop tester with engine at normal operating temperature and at idle speed.

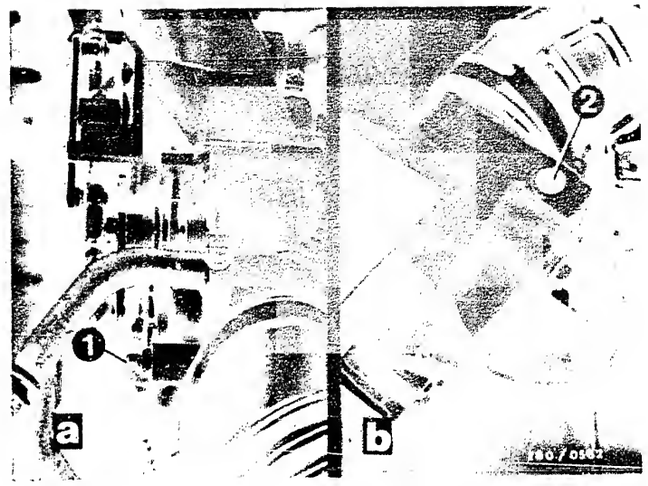
* Idle speed
  4-speed transmission:
  850...900 min^{-1}
  5-speed transmission:
  900...950 min^{-1}
  Automatic transmission:
  800...850 min^{-1}

* CO adjustment via lambda integrator voltage
  Lambda closed-loop control:

  Closed-loop mode (sensor connected):
  Voltage reading fluctuates between 2 values.

  Open-loop mode (sensor lead taken apart):
  Voltage reading must be identical with the average value of the fluctuating reading.

If not, adjust at bypass screw (CO-adjusting screw) in air-flow sensor (hexagon-socket-head cap screw AF = 5 mm).
Check idle speed and voltage reading once again. If necessary, make corrections in several steps.
After adjusting, use new seal (1 283 123 004).



1 = Idle-speed adjusting screw
2 = CO adjusting scew

FUEL CONSUMPTION TOO HIGH

Trouble-shooting program according to customer complaints

Procedure

The test is divided into 3 rows of boxes:

* The left-hand row contains the questions for the tests.
* The center row describes the testing and adjusting operations on the components.
* The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be conclusively answered with "yes" without testing, proceed to the next question down.
If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there.
After testing, continue trouble-shooting at the point at which you branched off.

START OF TROUBLE-SHOOTING

V

Ignition, engine etc O.K.? — N> — Remedy faults on ignition and engine.

yes

V

Electrical test with universal test adapter already performed? — N> — For testing, see Coordinates B07...B28.

yes

V

Fuel pressure test already performed? — N> — For testing, see Coordinates C01...C10.

yes

V

Continued on next picture page

K01 ——— ===>

K02 ——— <===>

Fuel consumption too high (continued 1)

V

Have all brakes released? N>

Adjust handbrake/drum brake so that there is no rubbing.

Y

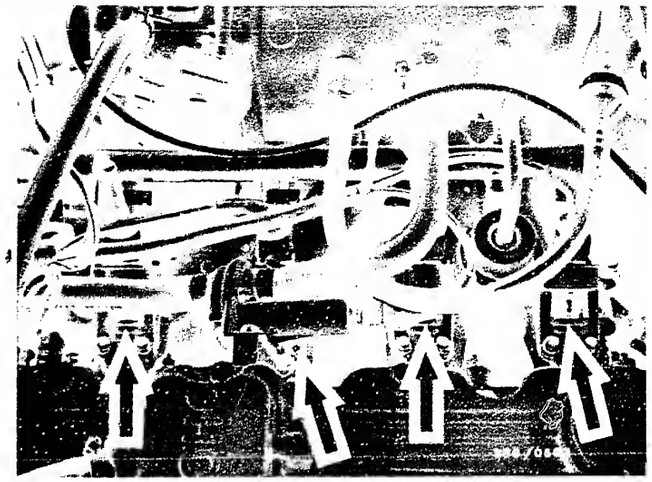
V

Injection valve mechanically O.K.? N>
* Does engine speed drop when injection-valve connectors are pulled off?

* With the engine running, disconnect injection-valve connectors individually, one after the other, from the injection valves and re-connect. Engine speed must drop if injection valve O.K.

* If replacing, install only injection valves 0 280 150 205.

Y



Arrows = Injection valves

V

Continued on next picture page

V

Continued on next picture page

K03 — <==>

K04 — <==>

Fuel consumption too high (continued 2)

Removal of injection valves:

Remove all injection valves from intake manifold. Loosen 2 screws.

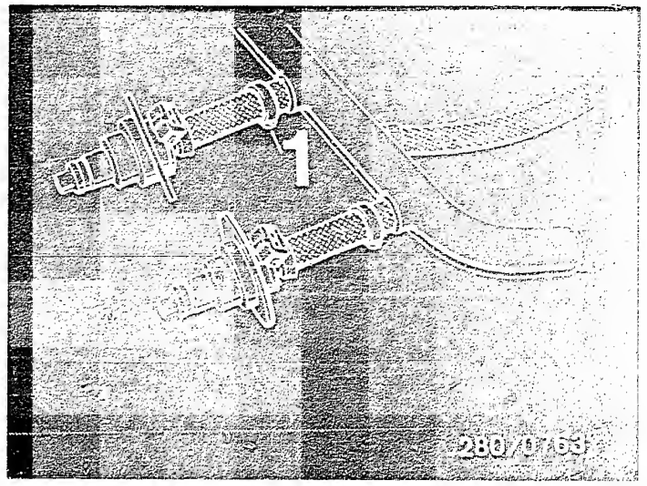
Remove fuel-distribution pipe.

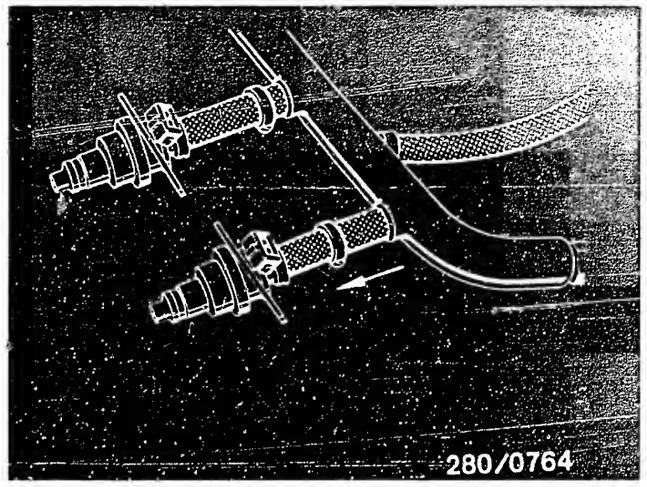
Loosen hose clamp (1) on injection valves.

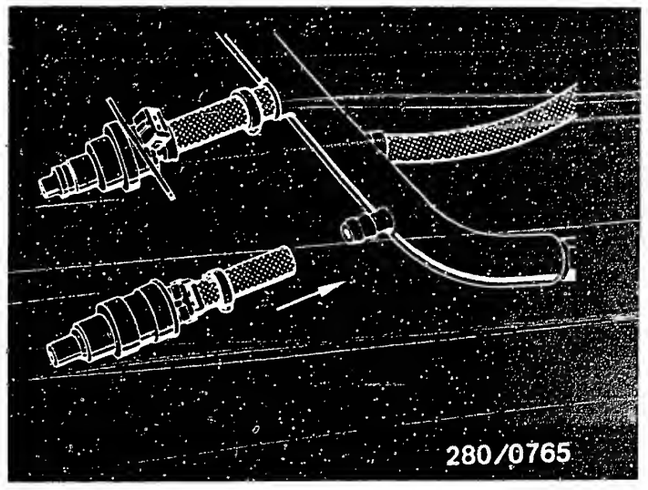
Remove fuel hose from fuel-distribution pipe.

Install new injection valve with hose sleeve. To do this, wet inside of hose with fuel and slide onto fitting as far as it will go. Note installation position of plug connection.

C a u t i o n !
The hose clamp on the injection valve must be securely tightened. Check for leaks. (Fire hazard!).







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Fuel consumption too high (continued 3)

1. Removal of hose

* Fastening parts on injection valve (O-ring) need not be removed.

* Insert injection valve into clamping fixture 1 688 120 093 and clamp in vise.

* Cut open hose sleeve with side-cutters and remove.

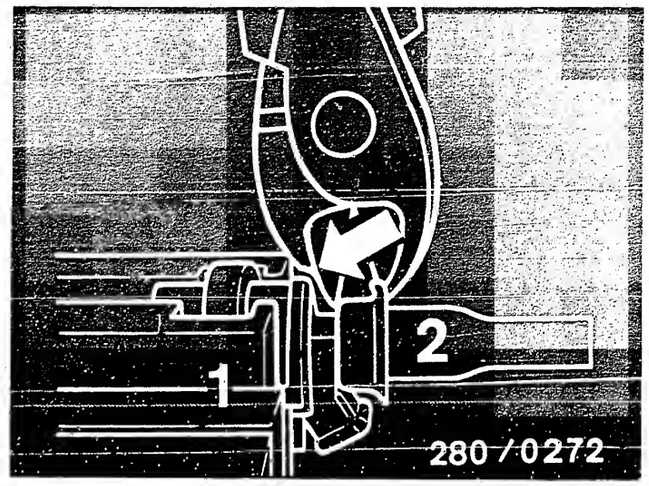
* Using a soldering gun or a soldering iron, cut open hose in longitudinal direction and pull off.

2. Mounting of hose

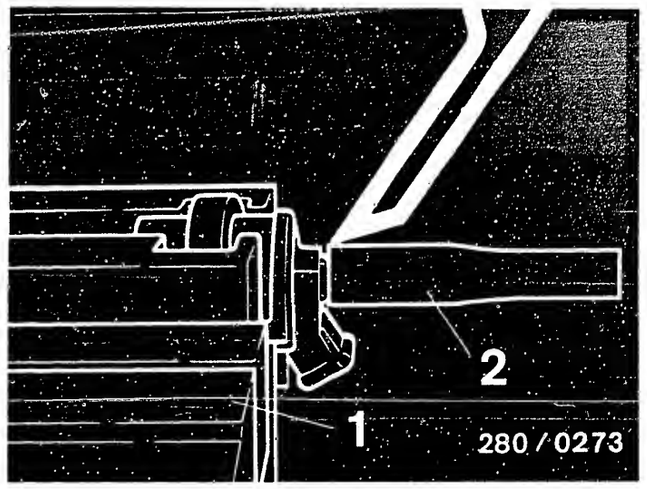
* Parts set 1 287 010 701 is required for mounting.

* Clean tailpiece on outside.

* Wet new fuel hose with fuel or calibrating oil.



1 = Clamping fixture (1 688 120 093)
2 = Solenoid-op. inj. valve



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Fuel consumption too high (continued 4)

V

Using assembly mandrel 1 687 931 003, press hose and hose sleeve by hand as far as they will go onto the tailpiece. Hose sleeve must then be tight.

C a u t i o n !

Do not use a hose clamp on the tailpiece of the injection valve.

Installation position of injection valves:

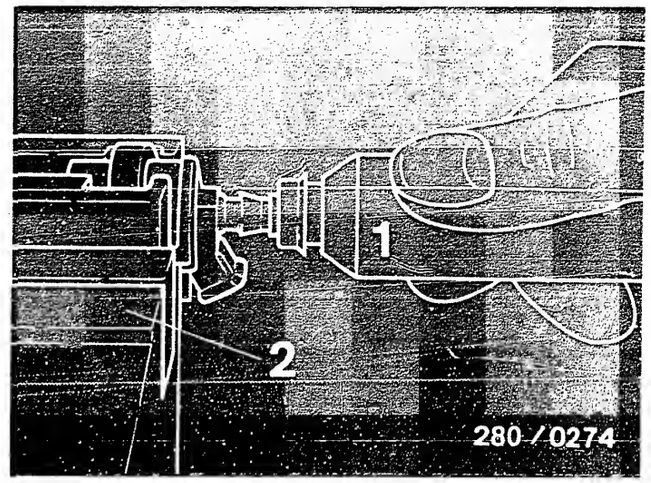
Ensure correct seating of rubber ring on each injection valve. Replace defective seals. Press all 4 injection valves with the fuel-delivery hoses uniformly into the connecting nipples.

Important!

All injection valves must be installed leak-tight. Securely tighten hose clamps on the injection valves. (Fire hazard in case of leaks!)

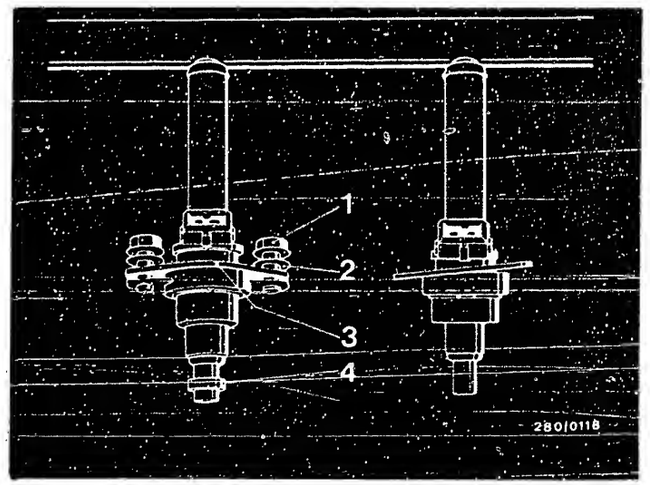
Connect all air/vacuum hoses. Screw on fastening screws for fuel-distribution pipe. Re-connect vacuum hoses, if removed.

Once again check all fuel- and air-hose connections for security. Start engine and check whether any unmetered air is being drawn in.



1 = Assembly mandrel (1 687 931 003)
2 = Clamping fixture

1 = Hexagon screw
2 = Plain washer
3 = Holder
4 = Rubber ring



V

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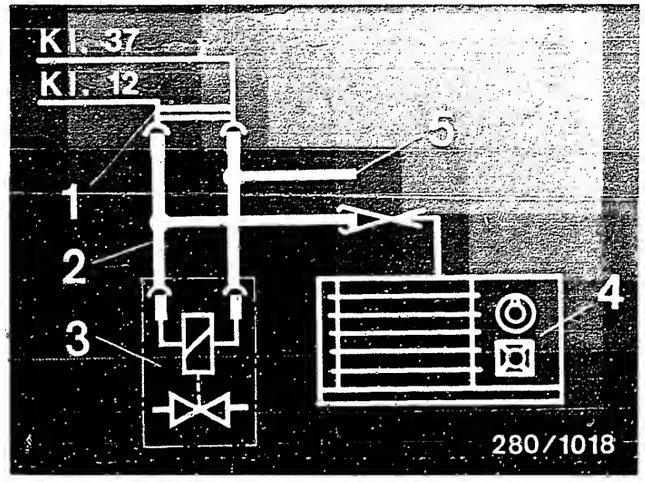
Fuel consumption too high (continued 5)

Solenoid-operated injection valves checked for correct operation?

* Injection pulses without interference or missing?
* Routing of lines correct?
* No loose contacts in plug-in connections?

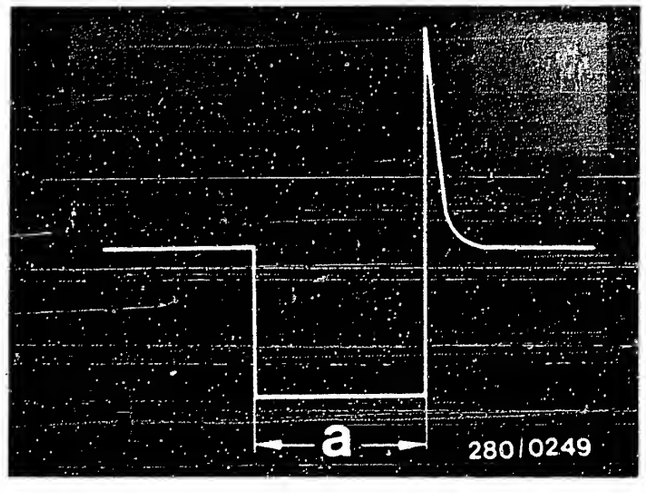
N>

* Connect test lead as follows: the 2-pole plug connections of the test lead are connected between a solenoid-operated injection valve and its connecting lead. Of the other two terminals of the test lead, only one terminal need be connected to the special input of the motortester.
* C a u t i o n !
  The free terminal must not come into contact with the vehicle body.
* If correctly connected, the pattern shown opposite will be visible on the oscilloscope. With the aid of the test lead it is possible to check the injection pulses at the injection valves with the ignition oscilloscope with the engine running. If the pattern shown opposite is not obtained or if there are deviations (interference, missing etc), the other injection valves should also be examined.
* In case of interference: check routing of leads.
* In case of missing: eliminate loose contacts in the leads or in the plug-in connections.



1 = Valve-lead connector
2 = Test lead 1 684 463 093
3 = Sol.-op- injection valve
4 = Motortester
5 = Free terminal (Do not bring into contact with ground)

a = Pulse length (dependent on engine load)



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Fuel consumption too high (continued 6)

Air-flow sensor mechanically and electrically O.K.?

* Sensor flap moving freely?
* Does sensor flap return to rest position?
* Resistances within tolerance?

Between term. 8 and term. 9:
160... 300 Ω

Between term. 7 and term. 5 (Deflect sensor flap fully):
60...1000 Ω

N>

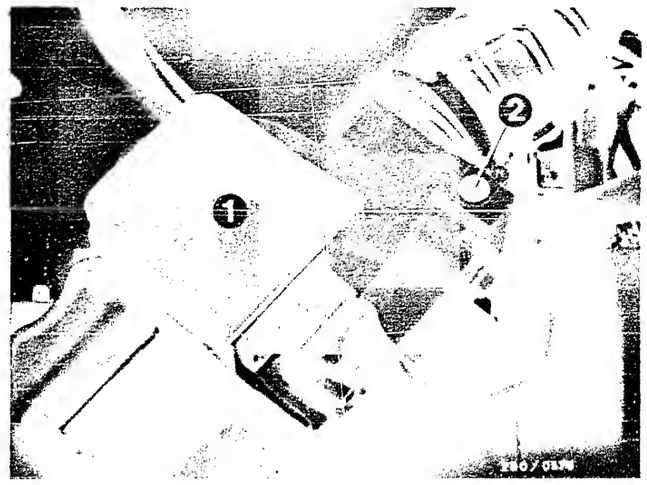
Testing:

* Unscrew air-flow sensor from air-flow filter housing. Open sensor flap by hand. It must be possible to open the sensor flap with uniform ease from its fully closed position to its fully open position. When released, it must close completely by itself. Sensor flap must not catch when opening. Watch for signs of rubbing or abrasion. Clean air-flow sensor if the inside is very dirty and rub out with a lint-free cloth. If there are signs of rubbing, replace air-flow sensor.

* Sensor flap must return to rest position. If not, the stopper or the sensor flap is bent. Replace air-flow sensor.

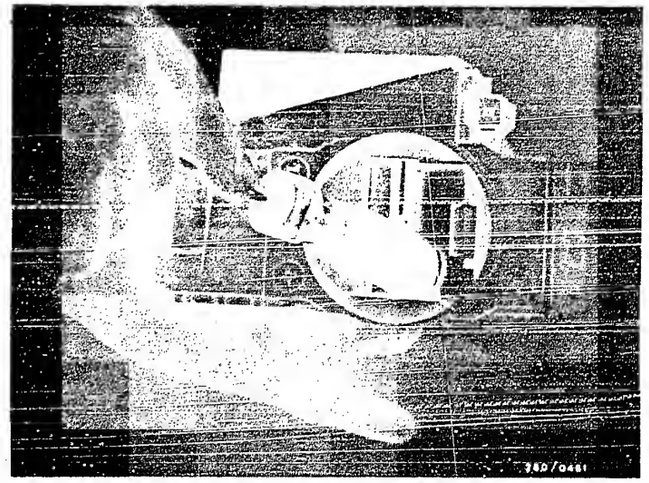
* Connect ohmmeter to term. 8 and term. 9 of air-flow sensor.
  Test specification: 160... 300 Ω
  Connect ohmmeter to term. 7 and term. 5 of air-flow sensor; deflect sensor flap.
  Test specification: 60...1000 Ω

C A U T I O N !
After testing is completed, the air-flow sensor must be screwed back onto the air-filter housing.



1 = Air-flow sensor
2 = CO adjusting screw

Opening the air-flow sensor flap



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Fuel consumption too high (continued 7)

Idle speed and CO correctly adjusted? N>

Y

Idle speed not adjustable.

Y

Trouble-shooting program for customer complaint

"fuel consumption too high"

completed.

If the fault has not been found or if further information is required on how to rectify the fault, continue with the trouble-shooting chart of your choice.

Detailed trouble-shooting chart coordinates B03/B04.
Direct trouble-shooting chart coordinates B05/B06.

Idle-speed and CO adjustment

Exhaust-gas adjustment with lambda closed-loop tester with engine at normal operating temperature and at idle speed.

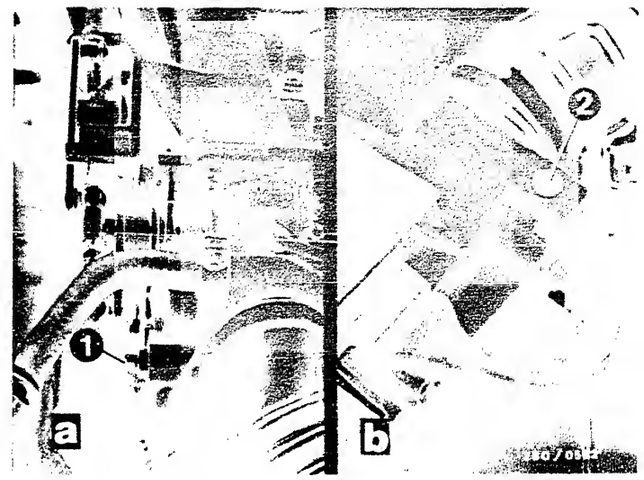
* Idle speed
  4-speed transmission:
  850...900 min $^{-1}$
  5-speed transmission:
  900...950 min $^{-1}$
  Automatic transmission:
  800...850 min $^{-1}$

* CO adjustment via lambda integrator voltage
  Lambda closed-loop control:

  Closed-loop mode (sensor connected):
  Voltage reading fluctuates between 2 values.

  Open-loop mode (sensor lead taken apart):
  Voltage reading must be identical with the average value of the fluctuating reading.

If not, adjust at bypass screw (CO-adjusting screw) in air-flow sensor (hexagon-socket-head cap screw AF = 5 mm).
Check idle speed and voltage reading once again. If necessary, make corrections in several steps.
After adjusting, use new seal (1 283 123 004).



1 = Idle-speed adjusting screw
2 = CO adjusting scew

MAXIMUM ENGINE POWER/TOP SPEED NOT REACHED

Trouble-shooting program according to customer complaints

Procedure

The test is divided into 3 rows of boxes:

* The left-hand row contains the questions for the tests.
* The center row describes the testing and adjusting operations on the components.
* The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be conclusively answered with "yes" without testing, proceed to the next question down.
If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there.
After testing, continue trouble-shooting at the point at which you branched off.

START OF TROUBLE-SHOOTING

Ignition, engine etc O.K.? — N> Remedy faults on ignition and engine.

yes

Electrical test with universal test adapter already performed? — N> For testing, see Coordinates B07...B28.

yes

Fuel pressure test already performed? — N> For testing, see Coordinates C01...C10.

yes

Continued on next picture page

L01 ⟹

L02 ⟺

Maximum engine power/top speed not reached
(continued 1)

V

Is throttle valve opening fully?

* Accelerator, throttle linkage, throttle cable O.K.?

N>

* Throttle linkage may stick due to floor mat.

* If throttle cable kinked -> replace.

V

Catalytic converter clogged?

* Comparative CO measurement

* Sensor-replacement interval

N>

Comparative CO measurement

* Loosen sensor connector (open-loop control) and measure the CO concentration after the catalytic converter (exhaust tail pipe) with engine at normal operating temperature. Note down reading.

* Remove sensor and measure the CO concentration in the sensor hole before the catalytic converter with the engine at operating temperature (ensure no leaks). Note down reading.

* If the two readings are virtually identical, the catalytic converter is clogged and must be replaced. If the catalytic converter is O.K., a CO concentration of less than 0.2 % CO by vol. will be measured at the exhaust tail pipe.

Replacement interval for lambda sensor approx. 50,000 km. Follow instructions of original-equipment manufacturer.

V

Continued on next picture page

Arrow = Lambda sensor

Maximum engine power/top speed not reached
(continued 2)

V

Full-load signal O.K.?

* Does injection-pulse length at idle change when term. 3 and term. 18 are jumped (full-load enrichment)? N>

Y

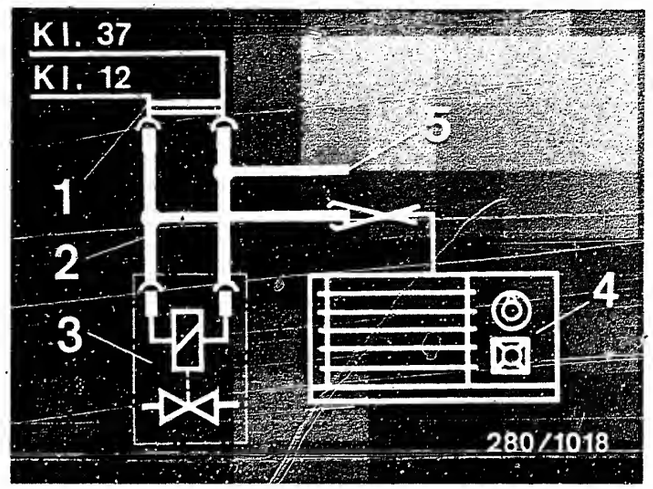
V

Continued on next picture page

Connect test lead:
Connect 2-pole plug connection between an injection valve and its connecting lead. Of the other two terminals, only one terminal need be connected to a motortester (special input). The other terminal must not come into contact with ground.

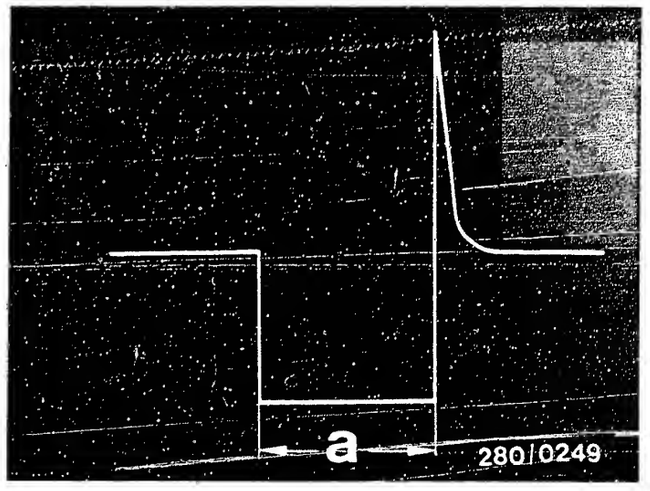
* If correctly connected, and with the engine running, injection pulses as in top picture.

* Check full-load enrichment
Watch injection pulses at idle.
Disconnect throttle-valve switch plug and jump term. 3 and term. 18 (lead 9) (insulated wire jumper). Do not bend connecting lugs.
Injection pulse must become longer.
If not: check connecting leads from control-unit plug to throttle-valve switch term. 3 and term. 18 (lead 9) for continuity. If O.K., replace control unit.



1 = Valve-lead connector
2 = Test lead 1 684 463 093
3 = Sol.-op- injection valve
4 = Motortester
5 = Free terminal
(Do not bring into contact with ground)

a = Pulse length
(dependent on engine load)



Maximum engine power/top speed not reached (continued 3)

V

Delivery of electric fuel pump O.K.? Test specification: min. 700 cm ^{3} /30 s — N>

Y

V

Continued on next picture page

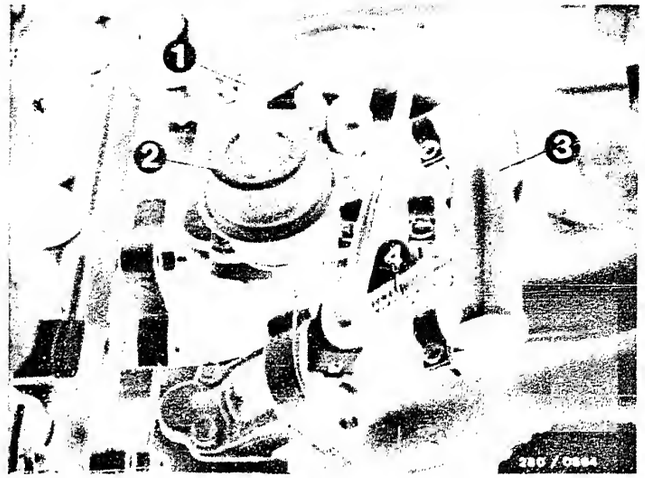
* Measuring the fuel delivery:
For testing, undo junction between fuel return hose (from pressure regulator) and fuel return line (to fuel tank). If necessary, extend hose and lead into a 5l vessel with graduated scale. Disconnect control relay. Connect jumper into connection base between term. 87b and term. 30. Electric fuel pump must operate.

Test specification:
min. 700 cm ^{3} /30s

Caution: After testing is completed, be sure to remove the jumper.

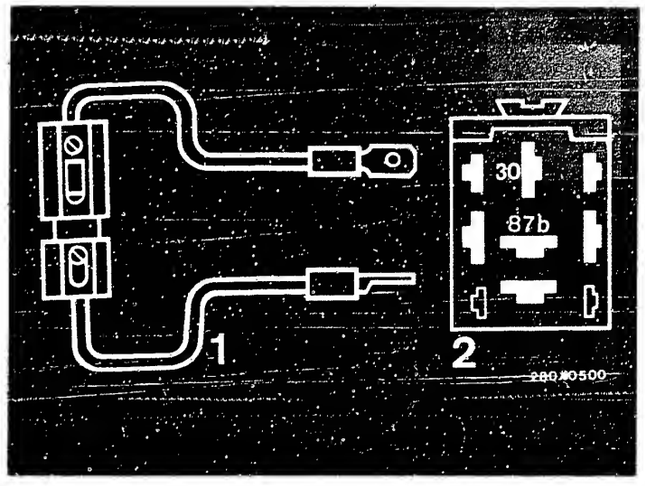
Remedy if test specification not obtained:
* Fuel filter clogged – replace.
* Voltage at the terminals of the electric fuel pump with engine running: min. 12 V. If not, clean contacts; possibly eliminate poor ground connection; replace leads.

* Fuel pressure regulator defective – replace.
* If delivery too low, replace electric fuel pump.



1 = Intake manifold connection
2 = Pressure regulator
3 = Fuel-distribution pipe (fuel delivery line)
4 = Fuel return line

1 = Jumper with fuse holder and 10 A fuse (user-fabricated)
2 = Top view of connection base



Maximum engine power/top speed not reached
(continued 4)

V

Air-flow sensor mechanically and electrically O.K.?

* Sensor flap moving freely?
* Does sensor flap return to rest position?
* Resistances within tolerance?

N>

Between term. 8 and term. 9:
160... 300 Ω

Between term. 7 and term. 5
(Deflect sensor flap fully):
60...1000 Ω

Y

V

Continued on next picture page

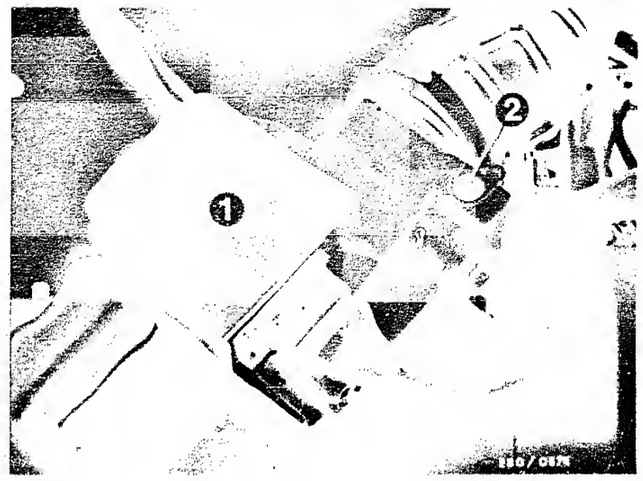
Testing:

* Unscrew air-flow sensor from air-flow filter housing. Open sensor flap by hand. It must be possible to open the sensor flap with uniform ease from its fully closed position to its fully open position. When released, it must close completely by itself. Sensor flap must not catch when opening. Watch for signs of rubbing or abrasion. Clean air-flow sensor if the inside is very dirty and rub out with a lint-free cloth. If there are signs of rubbing, replace air-flow sensor.

* Sensor flap must return to rest position. If not, the stopper or the sensor flap is bent. Replace air-flow sensor.

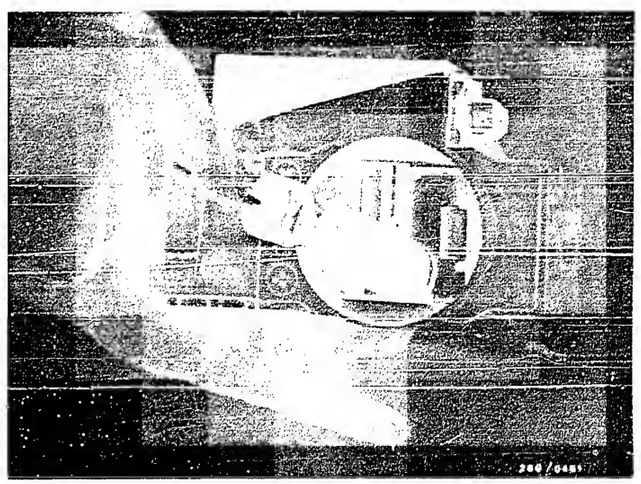
* Connect ohmmeter to term. 8 and term. 9 of air-flow sensor.
  Test specification: 160... 300 Ω
  Connect ohmmeter to term. 7 and term. 5 of air-flow sensor; deflect sensor flap.
  Test specification: 60...1000 Ω

C A U T I O N !
After testing is completed, the air-flow sensor must be screwed back onto the air-filter housing.



1 = Air-flow sensor
2 = CO adjusting screw

Opening the air-flow sensor flap



Maximum engine power/top speed not reached
(continued 5)

V

Are all hose lines correctly connected, not kinked or damaged?
Visual examination.

* Air-intake system checked for leaks with 0.3 bar gauge pressure?

N>

* Check whether hoses of air-intake system and fuel-line system are correctly connected, not kinked or damaged. If necessary, replace hoses.
Eliminate leaks by means of new seals or by retightening the connecting screws.

* Leak test:
Seal off exhaust tail pipe. Unscrew air-flow sensor from air-filter housing and seal off air-flow sensor duct.
Disconnect hose after auxiliary-air device and, using a compressed-air gun, blow air (0.3 bar gauge pressure) into the intake manifold.
Seal off connection port on auxiliary-air device.
Open throttle valve fully while doing this.
Brush or spray all joints with soapy water.
Leaks may also occur at the following points on the engine:
Oil dipstick not securely inserted, defective lid seal on oil filler neck etc.
Bubbling or foaming indicates a leak.

Y

V

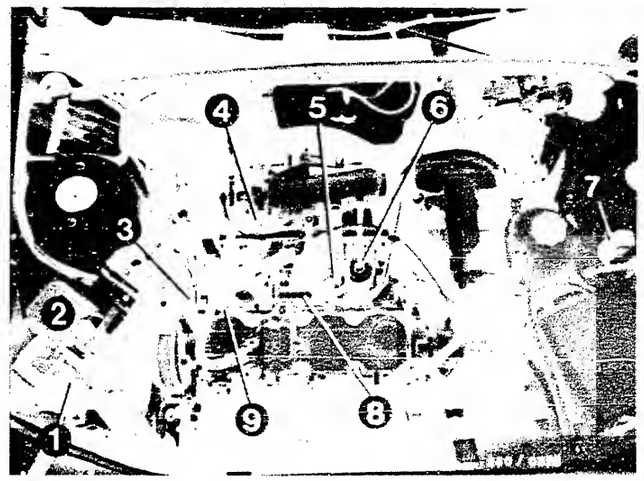
Trouble-shooting program for customer complaint

"maximum engine power/top speed not reached"

completed.

If the fault has not been found or if further information is required on how to rectify the fault, continue with the trouble-shooting chart of your choice.

Detailed trouble-shooting chart coordinates B03/B04.
Direct trouble-shooting chart coordinates B05/B06.



1 = Air filter
2 = Air-flow sensor
3 = Temperature sensor II
4 = Throttle-valve switch
5 = Solenoid-op. inj. valves
6 = Pressure regulator
7 = Control relay
8 = Auxiliary-air device
9 = Central ground

CO ADJUSTMENT AT IDLE TOO LOW OR TOO HIGH

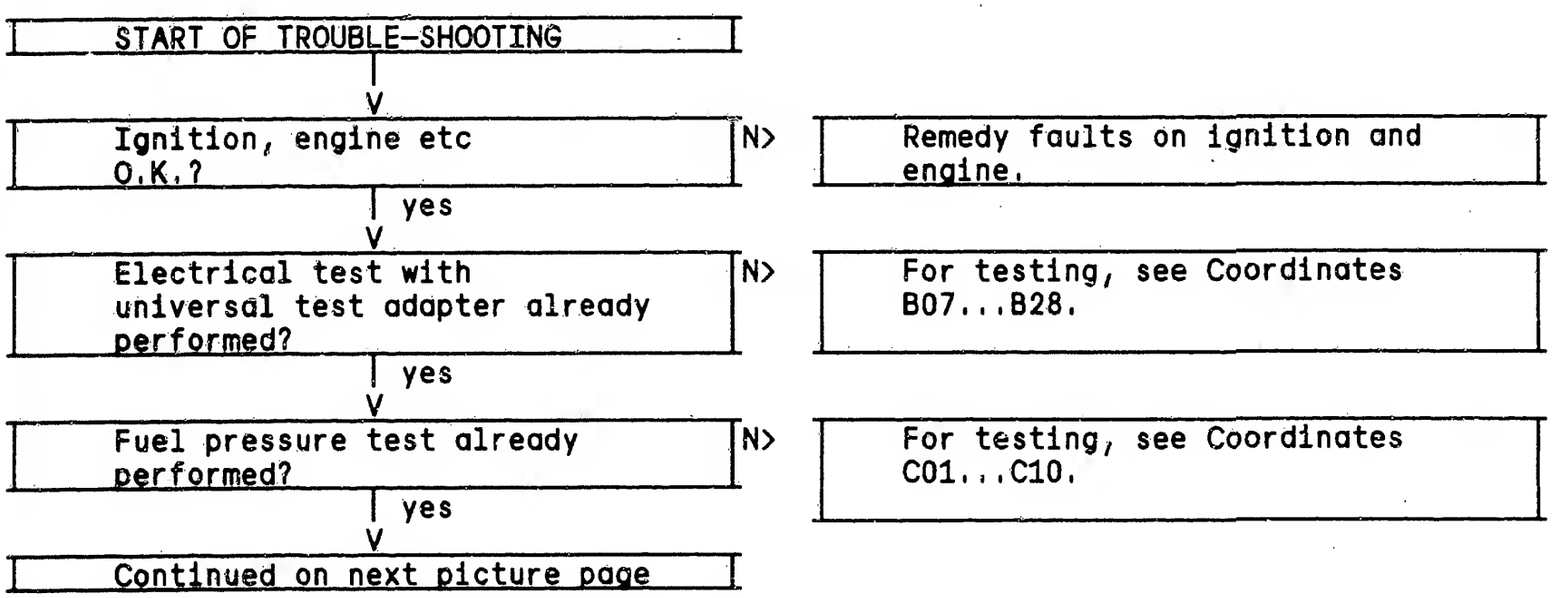
Trouble-shooting program according to customer complaints

Procedure

The test is divided into 3 rows of boxes:

* The left-hand row contains the questions for the tests.
* The center row describes the testing and adjusting operations on the components.
* The right-hand row shows the illustrations belonging to the text and explains the illustrations.

If the questions can be conclusively answered with "yes" without testing, proceed to the next question down.
If, on the other hand, the answer to the question is "no" and you suspect a fault, branch to the center row of boxes and carry out the tests given there.
After testing, continue trouble-shooting at the point at which you branched off.



M01 —— ==> M02 —— <==>

Idle speed and CO concentration too low or too high (continued 1)

Idle speed and CO correctly adjusted? N>

Y

Idle speed not adjustable.

Y

Idle-speed and CO adjustment

Exhaust-gas adjustment with lambda closed-loop tester with engine at normal operating temperature and at idle speed.

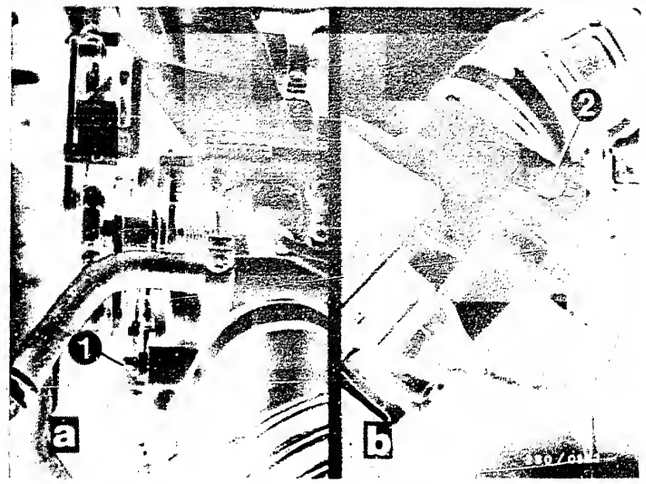
* Idle speed
  4-speed transmission:
  850...900 min $^{-1}$
  5-speed transmission:
  900...950 min $^{-1}$
  Automatic transmission:
  800...850 min $^{-1}$

* CO adjustment via lambda integrator voltage
  Lambda closed-loop control:

  Closed-loop mode (sensor connected):
  Voltage reading fluctuates between 2 values.

  Open-loop mode (sensor lead taken apart):
  Voltage reading must be identical with the average value of the fluctuating reading.

If not, adjust at bypass screw (CO-adjusting screw) in air-flow sensor (hexagon-socket-head cap screw AF = 5 mm).
Check idle speed and voltage reading once again. If necessary, make corrections in several steps.
After adjusting, use new seal (1 283 123 004).



1 = Idle-speed adjusting screw
2 = CO adjusting scew

Continued on next picture page

Idle speed and CO concentration too low or too high (continued 2)

Is idle speed adjustable?

Auxiliary-air device mechanically O.K.? N>

* cold – open?
* warm – closed?
* Drop in engine speed when hose pinched off? (Engine cold)

Y

Electrical operation of auxiliary-air device (power supply, ground lead, resistance) O.K.? N>

Y

Continued on next picture page

Checking the auxiliary-air device

*** Visual examination**

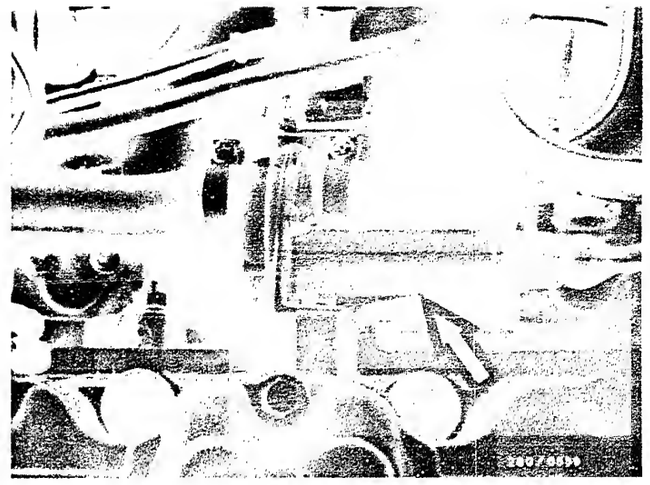
Disconnect hoses and look down (possibly using a small mirror). When cold, the cross section must be partially open; when the engine is warm, it must be closed. If not, replace auxiliary-air device.

*** Functional test:**

With the engine cold, pinch off hose to auxiliary-air device. Engine speed must drop. With engine warm, pinch off hose to auxiliary-air device. There must be no noticeable drop in engine speed. If not, replace auxiliary-air device (paying attention to direction of flow).

Start engine.

* Voltage at plug min. 12 V. If not, check the following leads for continuity (set value approx. 0 Ω).
* From term. 26 to central ground.
* From term. 9/2 to control relay term. 87.
* Resistance of auxiliary-air device 30...65 Ω (plug disconnected). If resistance not within tolerance, replace auxiliary-air device.



Arrow = Auxiliary-air device

Idle speed and CO concentration too low or too high (continued 3)

Air-flow sensor mechanically and electrically O.K.?

* Sensor flap moving freely?
* Does sensor flap return to rest position?
* Resistances within tolerance?

N>

Between term. 8 and term. 9:
160... 300 Ω

Between term. 7 and term. 5
(Deflect sensor flap fully):
60...1000 Ω

V

Continued on next picture page

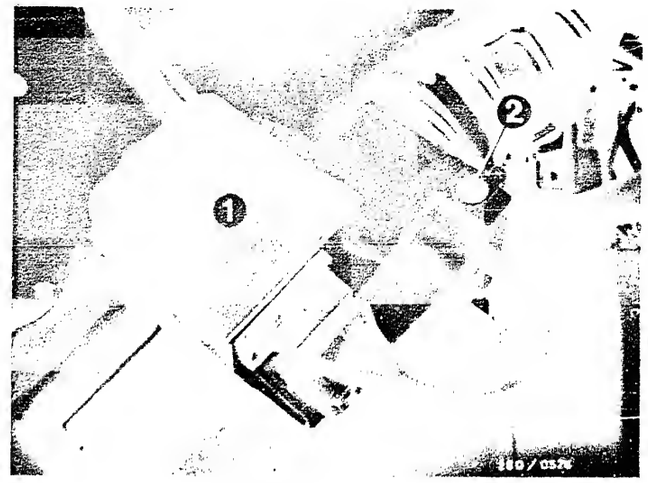
Testing:

* Unscrew air-flow sensor from air-flow filter housing. Open sensor flap by hand. It must be possible to open the sensor flap with uniform ease from its fully closed position to its fully open position. When released, it must close completely by itself. Sensor flap must not catch when opening. Watch for signs of rubbing or abrasion. Clean air-flow sensor if the inside is very dirty and rub out with a lint-free cloth. If there are signs of rubbing, replace air-flow sensor.

* Sensor flap must return to rest position. If not, the stopper or the sensor flap is bent. Replace air-flow sensor.

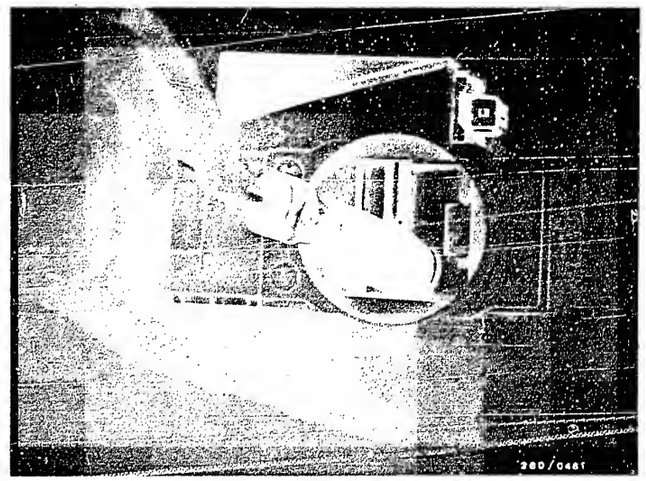
* Connect ohmmeter to term. 8 and term. 9 of air-flow sensor.
  Test specification: 160... 300 Ω
  Connect ohmmeter to term. 7 and term. 5 of air-flow sensor; deflect sensor flap.
  Test specification: 60...1000 Ω

C A U T I O N !
After testing is completed, the air-flow sensor must be screwed back onto the air-filter housing.



1 = Air-flow sensor
2 = CO adjusting screw

Opening the air-flow sensor flap



Idle speed and CO concentration too low or too high (continued 4)

Air-intake system checked for leaks?

* Hose lines correctly connected, not kinked or damaged? N>

Y

Trouble-shooting program for customer complaint

"idle speed and CO concentration too low or too high"

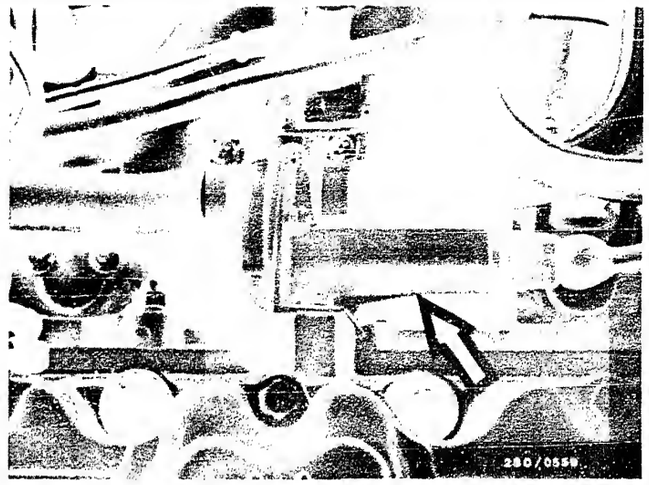
completed.

If the fault has not been found or if further information is required on how to rectify the fault, continue with the trouble-shooting chart of your choice.

Detailed trouble-shooting chart coordinates B03/B04..
Direct trouble-shooting chart coordinates B05/B06..

* Check whether hoses of air-intake system and fuel-line system are correctly connected, not kinked or damaged. If necessary, replace hoses.
Eliminate leaks by means of new seals or by retightening the connecting screws.

* Leak test:
Seal off exhaust tail pipe. Unscrew air-flow sensor from air-filter housing and seal off air-flow sensor duct.
Disconnect hose after auxiliary-air device and, using a compressed-air gun, blow air (0.3 bar gauge pressure) into the intake manifold.
Seal off connection port on auxiliary-air device.
Open throttle valve fully while doing this.
Brush or spray all joints with soapy water.
Leaks may also occur at the following points on the engine:
Oil dipstick not securely inserted, defective lid seal on oil filler neck etc.
Bubbling or foaming indicates a leak.



Arrow = Auxiliary-air device

MOTOR VEHICLE SERVICE INFORMATION

UNIVERSAL TEST ADAPTER

VDT-I-Gen. 1001 Ee
1.1982

1. Application

The multitude of injection and ignition systems on the market as well as the further developments which are to be expected call for a new test concept. To keep the outlay on testing equipment and thus the costs within limits, the universal test adapter has been developed.

With a basic test adapter and exchangeable, system-matched adapter leads, it is possible to test the following systems:

1.1 Systems which have been installed as standard equipment:

* L-Jetronic (1st generation)
* LE-Jetronic (L-Jetronic 2nd generation)
* Motronic (with new pin assignment, see vehicle-related instructions.)

1.2 Systems whose introduction is planned:

* Motronic with transmission control
* KE-Jetronic
* Mono-Jetronic
* Electric computerized ignition system (EZF)

2. Delivery dates and part numbers

Available as of 2.1982

2.1 Universal test adapter (basic unit)

Part No.: 0 684 101 801
Designation: ETT 018.01

2.2 System adapter lead for LE-Jetronic (L-Jetronic 2nd generation)

Part No.: 1 684 463 123
First application: for BMW 2.5/2.8 l Engines as of 9.81 and Opel 2.0 l engine (Manta/Rekord) as of 9.81

2.3 System adapter lead for Motronic with new pin assignment

(see vehicle-related instructions)
Part No.: 1 684 463 124
First application: Porsche 944 as of production, BMW as of approx 3.82 (Europe)

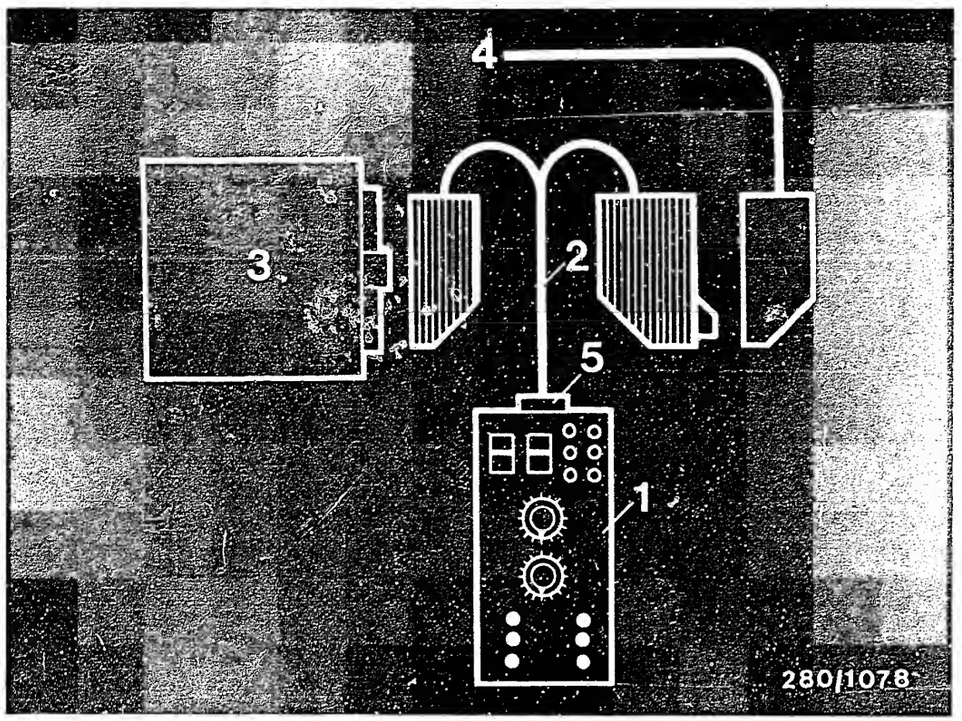
2.4 System adapter lead for L-Jetronic

(in preparation)
Further system adapter leads will be made available on the introduction of the above-mentioned systems.

3. Test concept

The systems and components are checked for voltage and resistance values as well as for correct operation. Evaluation is by means of multimeter and motortester which are connected to the universal test adapter.

Depending on the complexity of the system, the exchangeable adapter lead is offered in version 1 or 2.

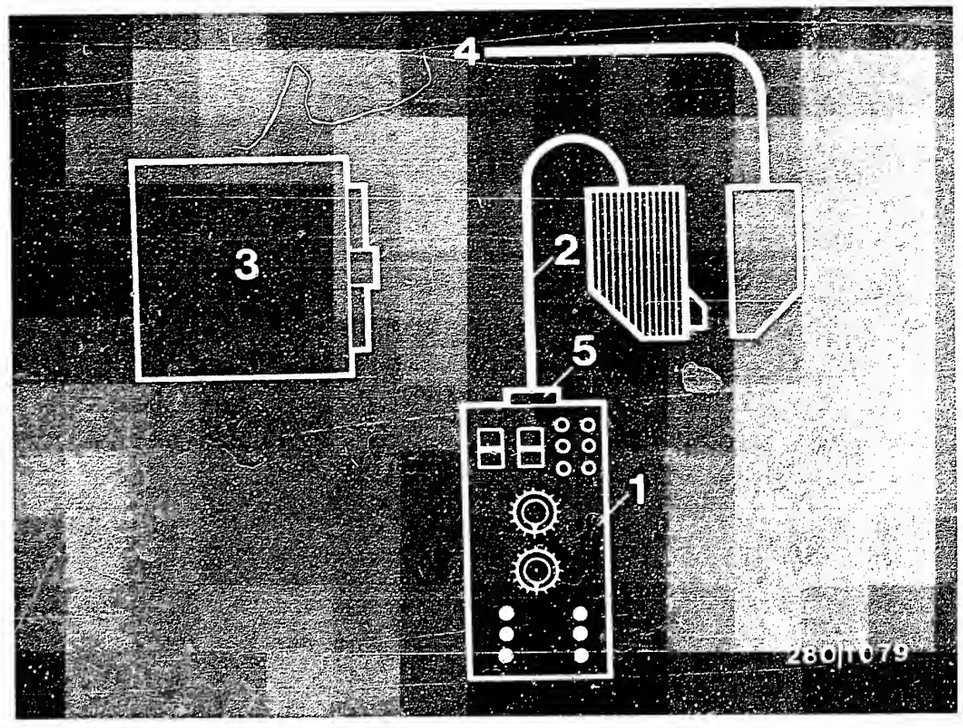


1 = Universal test adapter (basic unit)
2 = System adapter lead (Y version)
3 = Control unit
4 = System wiring harness
5 = Plug connector

3.1 Adapter lead for testing of peripherals and functional test (Version 1)

The universal test adapter with system adapter lead is to be connected to the system wiring harness and to the control unit (e.g. Motronic).

Scope of test: Wiring harness with components and control unit.



1 = Universal test adapter (basic unit)
2 = System adapter lead
3 = Control unit (not connected)
4 = System wiring harness
5 = Plug connector

3.2 Adapter lead for testing of peripherals (Version 2)

The universal test adapter with system adapter lead is to be connected only to the system wiring harness (e.g. LE-Jetronic (LE-Jetronic 2nd generation)).

Scope of test: Wiring harness with components (without control unit)

4. Construction of universal test adapter

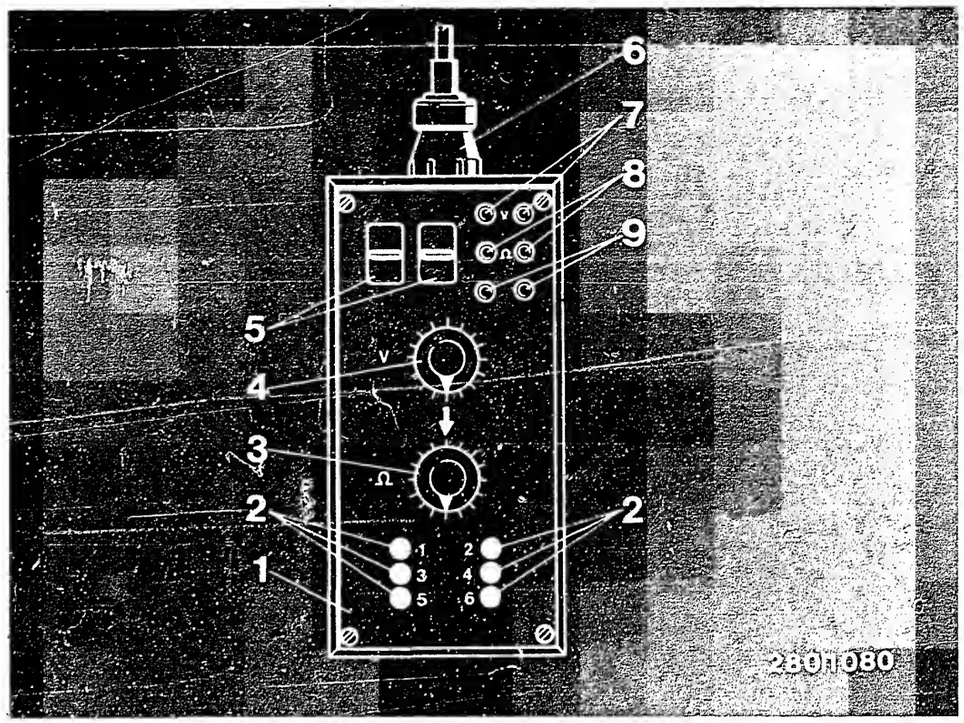
The universal test adapter contains 2 program switches for measuring voltages and resistances.

Readings are made on the multimeter which is connected to the universal test adapter.

For reasons of safety, the voltage and resistance sockets are separate.

To measure signals (e.g. injection pulses, ignition pulses), a motortester is to be connected to the test wells (special input).

For functional tests with the control unit connected, various engine operating conditions are simulated in some program steps by pressing certain buttons; the influence of these engine operating conditions is then evaluated with the motortester.



1 = Universal test adapter (basic unit)
2 = Button panel for simulation e.g. engine temperature, throttle position etc
3 = "Ohm" program switch for resistance measurements
4 = "Volt" program switch for voltage measurements
5 = Test wells (for the special input of the motortester)
6 = 63-pin plug connector for connection of system adapter lead
7 = Test sockets (voltage measurement with multimeter or motortester)
8 = Test sockets (resistance measurement with multimeter)
9 = Sockets for special functions (not yet occupied)

Notes:

1. The Motronic test adapter (0 684 101 800 ETT 018.00) is still used for BMW Motronic vehicles (with old pin assignment) up to approx 3.82 date of manufacture (see vehicle-related instructions).

2. Operation of universal test adapter and test specifications are to be found in the vehicle-related service instructions:

3. Caution: Change of Part Number:
   On SIS microcard OPE-00/J22 (Coordinates A14 und A17) the new part no. is

Universal test adapter	0 684 101 801
Adapter lead	1 684 463 123

Published by:

Robert Bosch GmbH
Division KH
After-Sales Service
Department for Training and Technology
(KH/VSK)

Please direct questions and comments concerning the contents to our authorized representative in your country.

TECHNICAL BULLETIN

CHANGE OF HOSES ON INJECTION VALVES OF D- AND L-JETRONIC

VDT-I-280/100 En
Ed. 1 4.7.1975

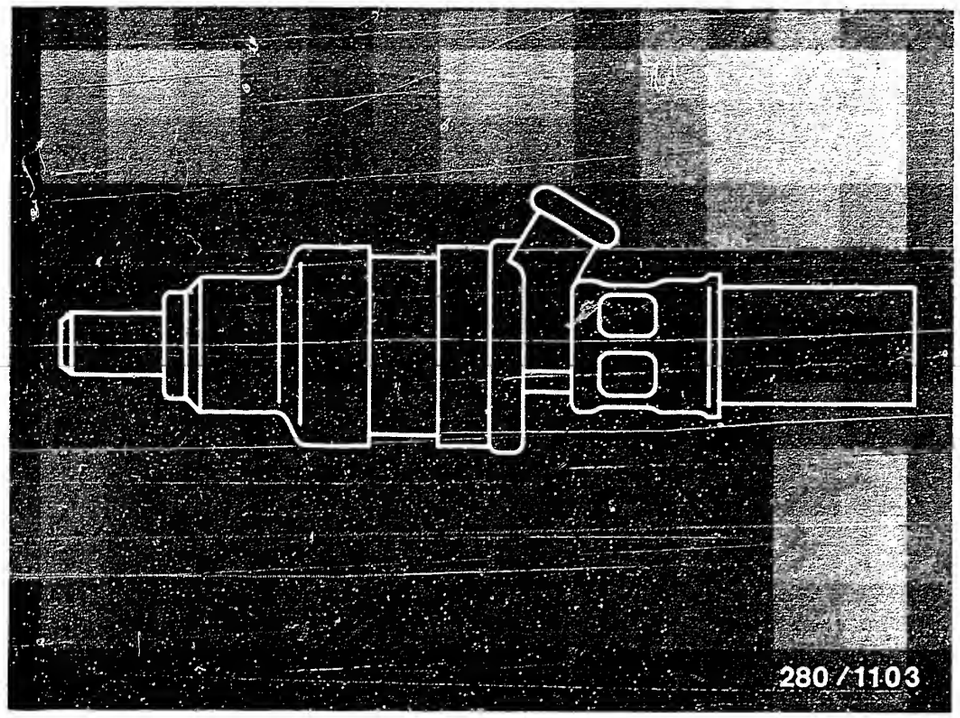
As injection valves with double sealing edges have been installed since February 1974, Daimler-Benz, Saab and Volvo have included the change of hoses in their after-sales service programs.

We have instructions on how to replace the hoses for the Bosch After-Sales Service workshops.

The aging of the hoses differs very greatly owing to the different service conditions of the vehicles (particularly differences in temperature). For safety reasons, therefore, the hoses must be checked with utmost care. It is not possible to give a general figure for the service life of the fuel hoses for all vehicles, neither in time nor in mileage.

As soon as the hoses are no longer in perfect condition, they must be repalced (e.g. when there are signs of cracks, brittle or soft areas etc.).

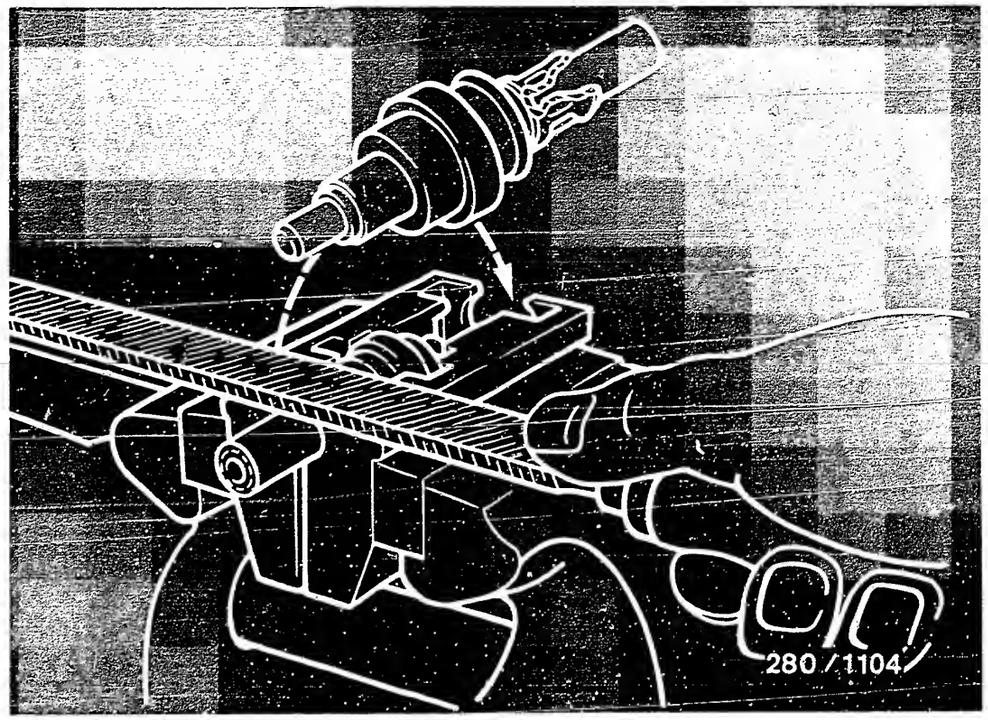
Tool 1 688 120 093 must be used for correct removal and installation.



The following parts sets are available for the various models of injection valve.

1. Parts set 1 287 010 700
   for valves with crimped hose sleeve (picture).

2. Parts set 1 287 010 701
   for valves with short hose sleeve and double sealing edge

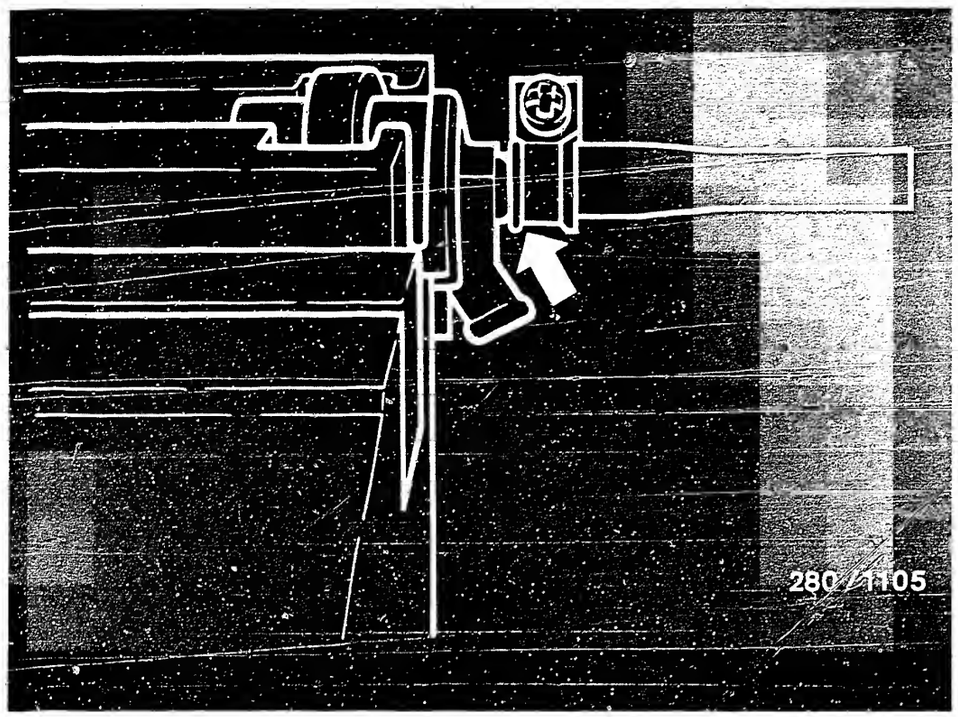


Information on installation:

Re 1: Parts set 1 287 010 700
(for valve with crimped hose sleeve)

Removal of hose

* Fastening parts on the injection valve (rubber ring, bearing) need not be removed.
* Insert injection valve into clamping fixture 1 688 120 093 and clamp in vise.
* File open hose sleeve. (Use flat file, smooth narrow side on valve).
* Insert injection valve into oppostive side of clamping fixture and clamp in vise.
* Cut open hose sleeve with side-cutters and pull off hose.



Installation of hose:

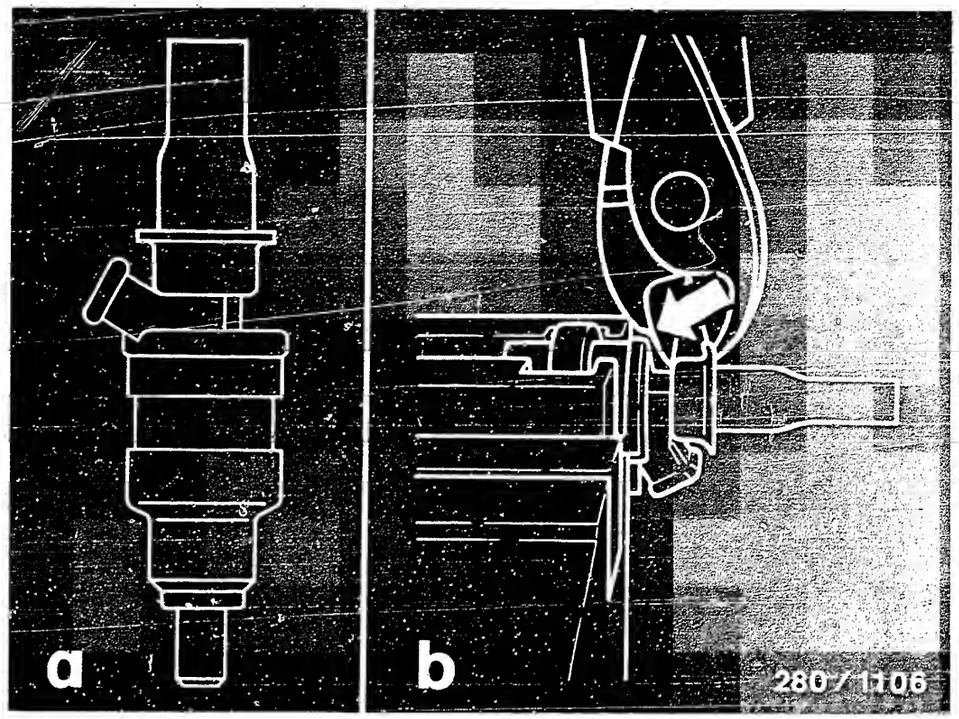
1. Clean tailpiece on outside.

2. Slide new hose as far as it will go onto tailpiece.

3. Slide on hose clamp as far as the electrical plug connection and tighten so that there is still 2 mm of thread visible in the middle.

C a u t i o n !

Do not tighten clamp all the way.
Fuel hoses that have been loosened once must not be re-used.



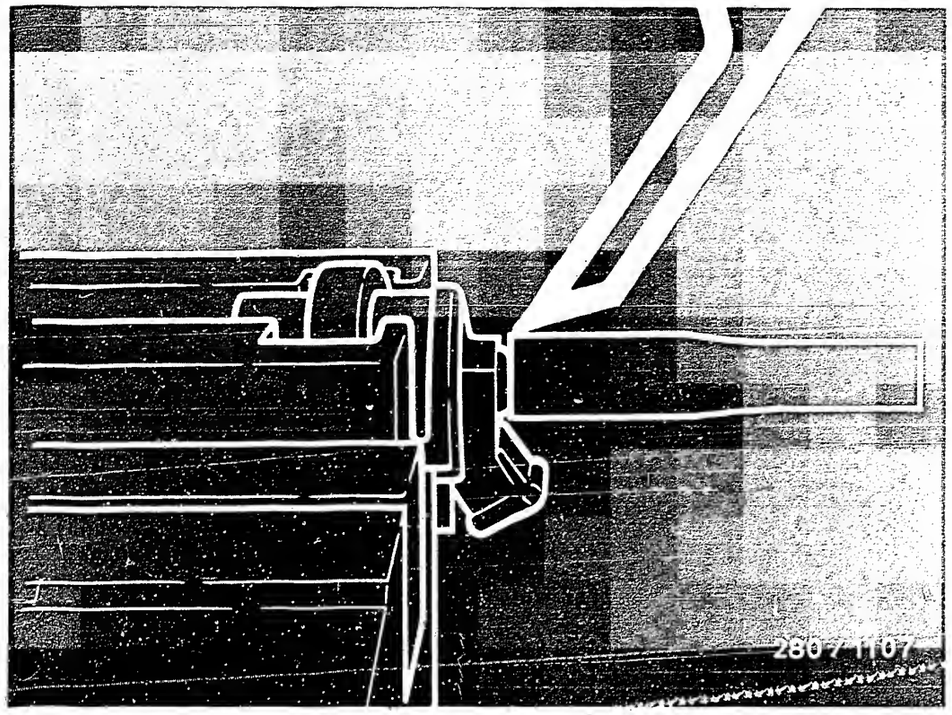
Re 2: Parts set 1 287 010 701
(for valves with short hose sleeve and double sealing edge – picture a)

Removal of hose

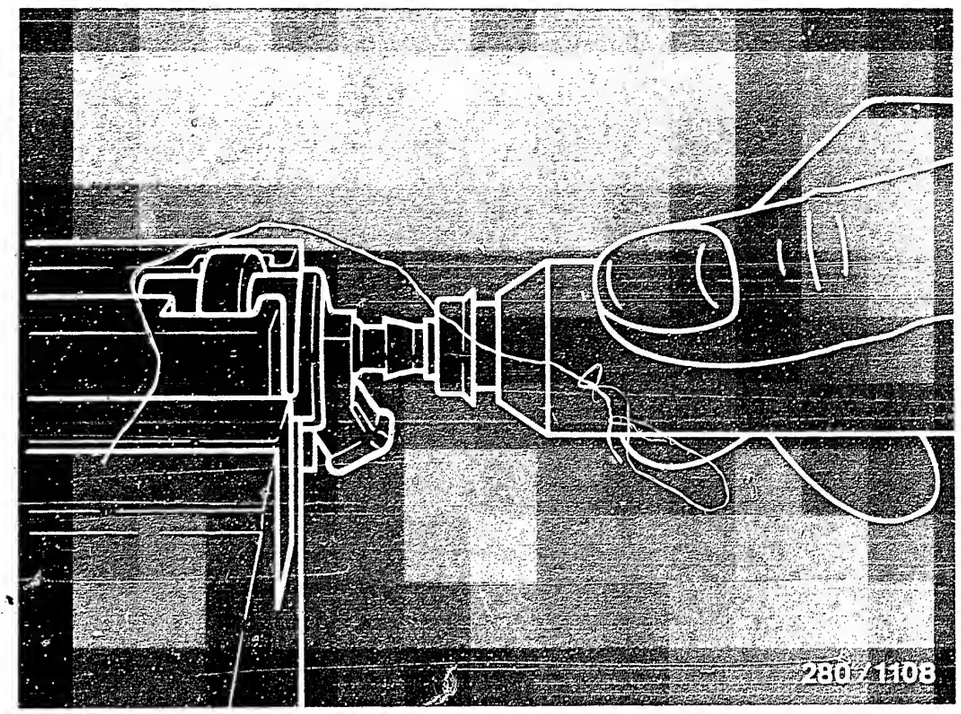
* Fastening parts on injection valve (rubber ring, bearing) need not be removed.

* Insert injection valve into clamping fixture 1 688 120 093 and clamp in vise.

* Cut open hose sleeve with side-cutters modified) and remove (picture b).



* Using a sold. gun or sold. iron, cut open hose in longitudinal direc. and pull off.



Installation of hose

1. Clean tailpiece on outside.
2. Wet new fuel hose with fuel or calibrating oil.
3. Using assembly mandrel 1 687 931 003, press hose and hose sleeve by hand as far as they will go onto the tailpiece. Hose sleeve must then be tight.

C a u t i o n !
Do not use a hose clamp on the tailpiece of the injection valve.

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|28|

D- AND L-JETRONIC

VDT-I-280/101 En
26.8.1976

Packaging of warranty-claim goods

All parts or products of the D- or L-Jetronic, that are shipped for a warranty-claim decision must be properly and carefully packaged, so that no further damage or impairment occurs in transit. No claims can be entertained for such damage.
Fuel remains must be removed from D- or L-Jetronic assemblies intended for shipping in order to prevent any fire risk in transit.
The inlet and outlet openings of the assemblies must be sealed with caps or plugs. Since new products have been installed, the caps or plugs from them can be used.
In addition, the assemblies must be packaged in tightly fitting, well sealed plastic sleeves.
If components arrive damaged as a result of improper packaging or if they do not conform to these guidelines, they may be refused and the warranty will be rejected.

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|28|

MOBILE AND INSTALLAED TRANSMITTING EQUIPMENT IN VEHICLES WITH L-/LE-JETRONIC

VDT-I-280/106 En
9.1984
(supersedes Ed. 4.1981)

Influence on engine operation and corrective action

If there are malfunctions during operation in vehicles with L-/LE-Jetronic in which permanently installed or mobile radio equipment is operated (engine bucking, stalling etc.), the following measures may be implemented to eliminate such malfunctions:

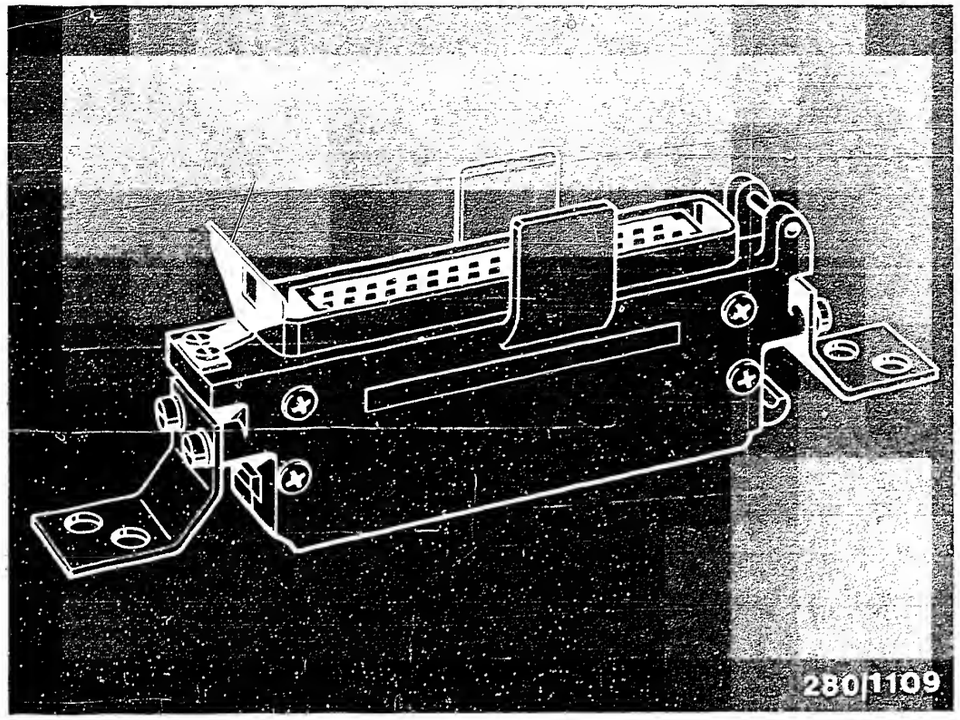
* Bridge over hinges on engine hood and luggage-comp: lid with flexible copper ground strap (good ground connect.!).

* Using a copper ground strap, ensure a good ground connection between the base of the antenna and the vehicle body.

* Position radio antenna and transmitter as far as possible away from the Jetronic control unit in the vehicle.

* Match the transmitter to the radio antenna with as low a reflection factor as possible.

* Prevent the parallel routing of cables of the transmitter power supply and antenna with the Jetronic wiring harness (danger of coupling-together and cross-talk).



Suppressor D 280 208 091 (L-Jetronic)
Suppressor D 280 208 280 (LE-Jetronic)
Illustrations similar.
If, despite the above-mentioned corrective action, there are still malfunctions, it is possible to further improve the degree of interference suppression by connecting the suppressor D 280 208 091 (L-Jetronic) or D 280 208 280 (LE-Jetronic) between wiring-harness plug and Jetronic control unit.
Order as follows:

1. In Germany	Order suppressors through Bosch wholesaler from KH/VKD 2.
2. Outside Germany	RG/AV ordering with "DB11" order form from KH/VKD 2.
Prices	On request.

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TECHNICAL BULLETIN

DETERMINATION OF TEMPERATURE VALUES GIVEN IN L-JETRONIC DOCUMENTATION

VDT-I-280/108 En
05.1982

Recently, there have been many inquiries as to how to measure the engine temperature precisely when trouble-shooting on the vehichle.

So far, in its L-Jetronic documentation, KH/VSK has given three or four different temperatures for testing the temperature sensor:

- 10° C, + 20° C, + 40° C and + 80° C.

two ranges for the thermo-time switch
e.g. 35° C 8 sec.

below + 30° C and above + 40° C.

Since the temperature range need not be subject to such close tolerances, we suggest in future the following definition, which is more suitable for workshop practice:

* Ambient temperauture
  (approx. +15° C to + 30° C)

* Engine at normal operating temperature
  (approx. + 80° C).

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T E C H N I C A L B U L L E T I N

ENCODING OF LE/LH-JETRONIC
SOLENOID-OPERATED INJECTION VALVES

VDT-I-280/109 En
5.1982

With the introduction of the LE/LH-Jetronic, the internal resistance of the solenoid-operated injection valves has also been changed.

Solenoid-operated injection valve

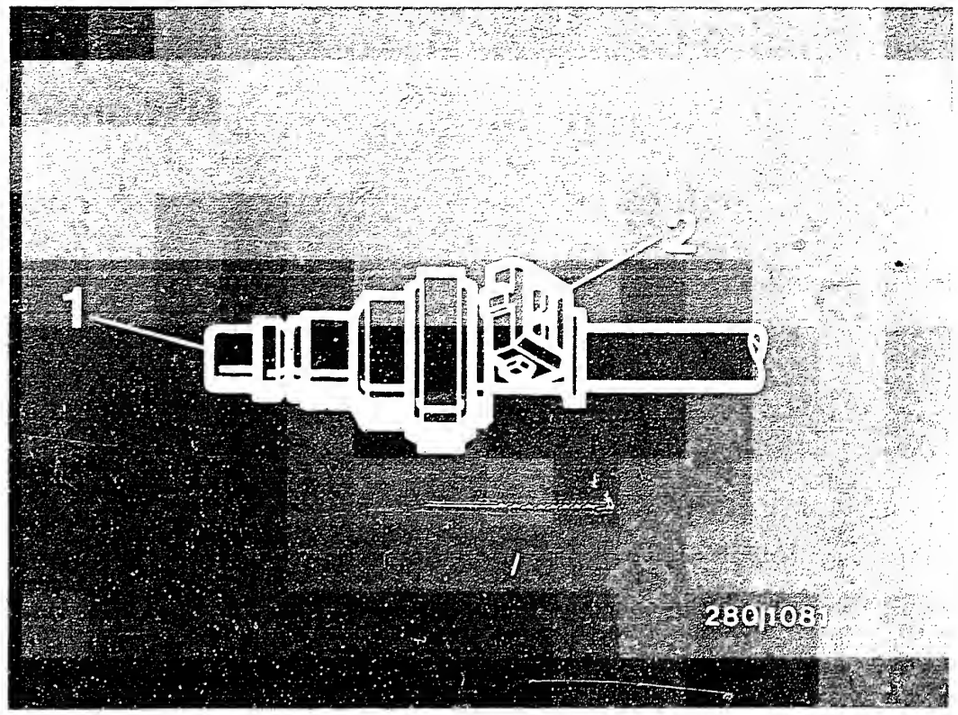
* L-Jetronic: 2.5 Ω at + 20° C
* LE/LH-Jetronic: 16.2 Ω at + 20° C

For cost and customer reasons, the plug contact has been left the same.

Caution:
If L-Jetronic solenoid-operated injection valves are installed in an LE/LH-Jetronic vehicle, either the control unit or the solenoid-operated injection valves will be destroyed.

Note:

* Install only solenoid-operated injection valves having the correct part number for the vehicle in question.
* As a guide, solenoid-operated injection valves with 16.2 Ω internal resistance have a yellow protective sleeve.



1 = Protective sleeve 2 = Plug connection

* Color coding (yellow) of the plug connection (see also VDT-I-280/5) is not generally intended for LE/LH-Jetronic solenoid-operated injection valves.

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T E C H N I C A L B U L L E T I N

PLUG CONNECTORS FOR JETRONIC COMPONENTS

|28|
VDT-I-280/111 En
11.1984

Parts sets

(supersedes Ed. 11.1982)

Parts sets are available for the replacement of Jetronic plug connectors. The parts sets consist of:

* Plug connector housing
* Protective cap (rubber sleeve)
* Contact springs

These parts are listed on microcard EE... [1]). see microcard EE00 under 280 ...

* Plug, black, 2-pole,
  Parts set 1 287 013 002 cable connector in conjunction with socket, 2-pole.

* Socket, black, 2-pole,
  Parts set 1 287 013 001 for e.g.:
  - Temperature sensor 0 280 130 0..
  - Auxiliary-air device 0 280 140 ..
  - Thermo-time switch 0 280 130 2..
  - Start valve 0 280 170 ..
  - Warm-up regulator 0 438 140 ..

* Socket, gray, 2-pole
  Parts set 1 287 013 003 for:
  - Injection valve 0 280 150 ..

* Socket, black, 3-pole,
  Parts set 1 237 000 039 for:
  - Throttle-valve switch 0 280 120 ..

* Socket, black, 5-pole,
  Parts set 1 287 013 006 for:
  - Air-flow sensor 0 280 20. .. (LE version)

* Socket, black, 6-pole,
  Parts set 1 287 013 004 for
  - Air-flow sensor 0 280 200 ..

* Socket, black, 7-pole,
  Parts set 1 287 013 005 for:
  - Air-flow sensor 0 280 20. ..
  - Air-flow sensor 0 280 211 ..

* Wiring-harness plug connector, black, 25-pole,
  Parts set 1 287 013 009 for:
  - Control unit 0 280 0..

* Wiring harness plug connector, black, 35-pole,
  Parts set 1 287 013 008 for:
  - Control unit 0 280 0..

The contact springs (minitimers) are also available separately under Part No. 1 284 477 026.

The plug connector housings are available only in the stated colors.

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TABLE OF CONTENTS

When carrying out direct trouble-shooting for a particular LU- version it is essential to look for the appropriate test step in accordance with the customer complaint.

Table of Contents (continued)

IMPRESSUM

Automotive Equipment – After-Sales Service
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